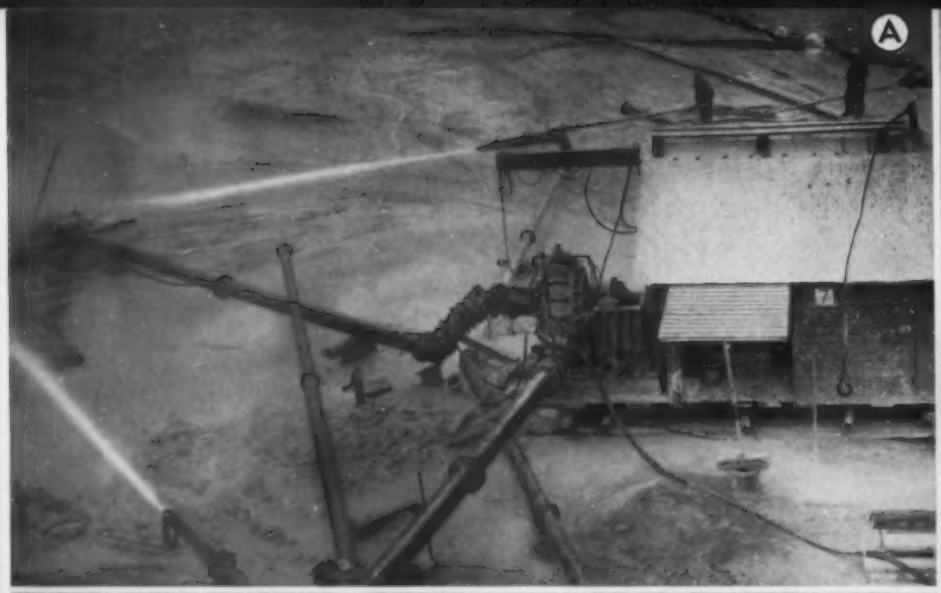
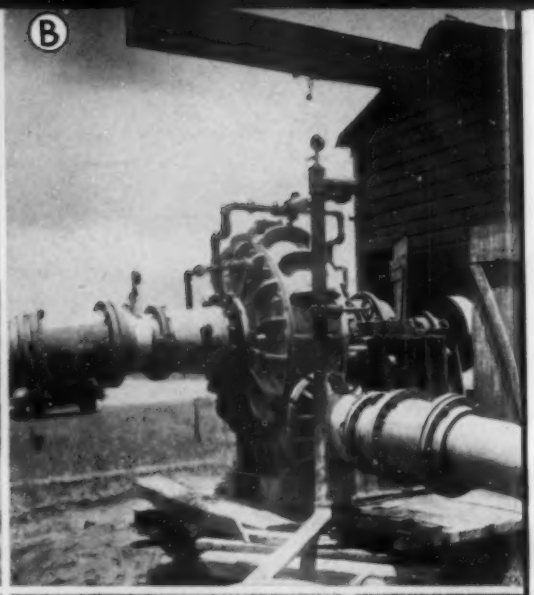
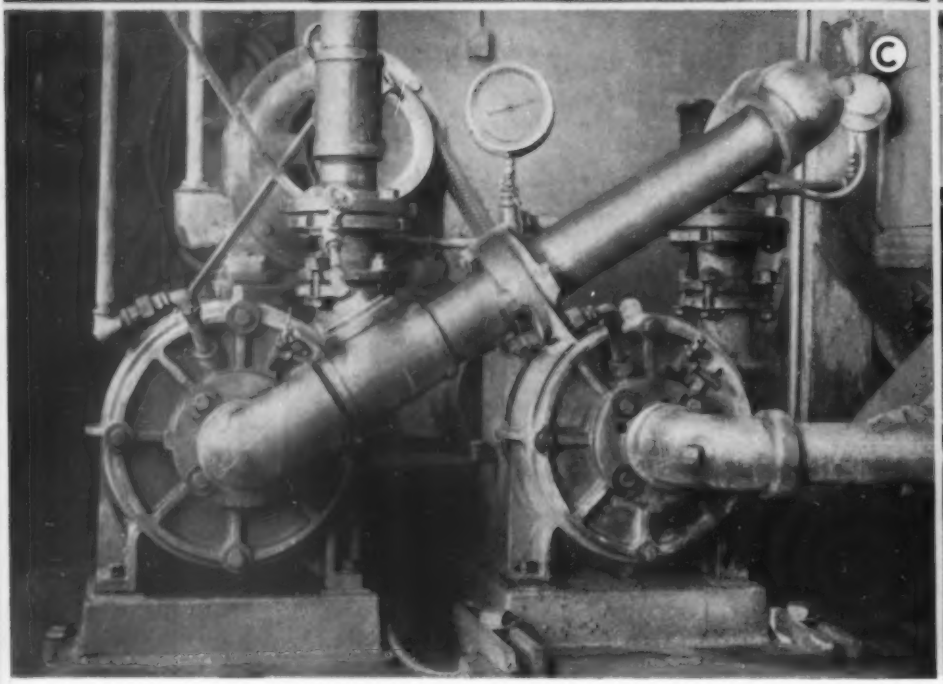
Rock Products

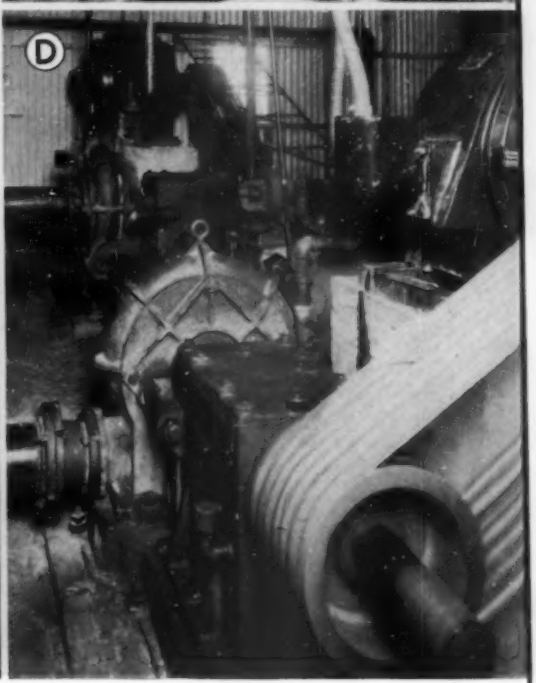
THE INDUSTRY'S RECOGNIZED AUTHORITY

JUNE, 1938









LONG-DISTANCE PUMPING

One of the two Maximix Rubber Side Plate Liners used in Hydroseal Dredge Pumps, twisted to demonstrate its flexibility. Maximix outlasts metal. Replacements are inexpensive and easy.

Two Stage or Booster

Hydroseal Dredge Pumps are built in all sizes from 2" up to 12", 14", 16" or larger. In some installations, one large pump proves most satisfactory for long-distance pumping. Often, however, a booster pump is better, as shown in Photo B which is, in this case, 1700 feet from the dredge pump A and pumps 4000 G.P.M. 3000 feet through a 14" line. In other conditions, two stage pump installations as shown in Photos C and D are more economical, since both pumps are together with the discharge of one pump piped to the suction of another. If your conditions require long-distance pumping, the advantages of the Hydroseal Principle introduce substantial installation and operating economies. Send for Catalog No. 937.

HYDROSEAL MAXIMIX RUBBER PROTECTED DREDGE PUMPS

HYDROSEAL AND MAXIMIX DESIGNS ARE COVERED BY PATENTS AND APPLICATIONS IN THE MAJOR MINING CENTERS OF THE WORLD AND CAN BE PURCHASED ONLY THROUGH THESE COMPANIES

U. S. A.: THE ALLEN-SHERMAN-HOFF CO. 221 S. 10th St., Philadelphia, Pa. CANADA: ALLEN-SHERMAN-HOFF, LTD. 502 Colonial Bldg., 11 King St., West, Toronto, Ont. ENGLAND: THE ASH CO. (LONDON), LTD. 79/80 Petty France, Westminster, S.W. 1, London PHILIPPINE ISLANDS: ATKINS, KROLL & CO., INC. Insular Life Bldg., Manila

SOUTH AFRICA: THE DENVER MACHINERY CO., LTD., 206 Commissioner St., Johannesburg AUSTRALIA: CROSBIE & DUFF PTY., LTD., 360 Collins Street, Melbourne

Economize with LINK-BELT ANTI-FRICTION CONVEYORS

These are the Link-Belt Positive Self-Aligning Idlers, spaced at suitable intervals, that automatically maintain the conveyor belt in a central carrying position without injury to its edges.

The many Anti-Friction Idlers used on the conveyors illustrated are Link-Belt Type 40. Type 41 return-run idlers are employed. There were 20 conveyors on the order, all Link-Belt equipped.

● Good idlers are of vital importance to satisfactory belt conveyor operation. They preserve the belt, reduce power requirements and maintenance expense, and give long trouble-free service. Link-Belt Anti-Friction Idlers are the product of years of specialization in this field. Among the more recent developments is the Link-Belt Positive Self-Aligning Idler for automatically maintaining the proper position of belt. Submit your conveyor problems to Link-Belt, and let us furnish you the style and type of equipment that will bring you the best results. Catalog sent on request.

THE SYMBOL OF QUALITY · LB · LINK-BELT

LINK-BELT COMPANY

The Leading Manufacturer of Equipment for Handling Materials and Transmitting Power

CHICAGO INDIANAPOLIS PHILADELPHIA ATLANTA SAN FRANCISCO TORONTO

Offices located in principal cities

7234-B

Rock Products

With which has been consolidated the journals

CEMENT and ENGINEERING NEWS CONCRETE PRODUCTS

Founded 1896 Est. 1918

RECOGNIZED THE WORLD OVER AS THE LEADER IN ITS FIELD

Contents

JUNE, 1938

▼ ▼ ▼

DEPARTMENTS

NATHAN C. ROCKWOOD
President and Editor

RALPH S. TORGERSON — *Managing Editor*
BROR NORDBERG — *Associate Editor*

M. F. HOPKINS
Assistant Editor

Contributing Editors

VICTOR J. AZBE
St. Louis, Mo.

DR. F. O. ANDEREGG — *Newark, Ohio*
GEO. D. ROALFE — *Los Angeles, Calif.*

●

Owned and Published by

TRADEPRESS PUBLISHING CORPORATION

PUBLICATION OFFICES

205 West Wacker Drive, Chicago, Ill.
Telephone—Central 0670

GEORGE C. WILLIAMS, General Manager

L. V. RODDA, Circulation Manager

RALPH G. WHITE, Advertising Manager

Advertising Representatives

George M. Earnshaw, Eastern Manager,
56 W. 45th St., New York City,
Tel. Murray Hill 2-3006

850 Euclid Ave., Cleveland, Ohio
Tel. Cherry 4050

Louis C. Thaon, Western Representative,
Chicago office, Tel. Central 0670

H. W. Booth, West Coast Representative,
524 Spring St., Los Angeles, Calif.
Madison 6909

London Office

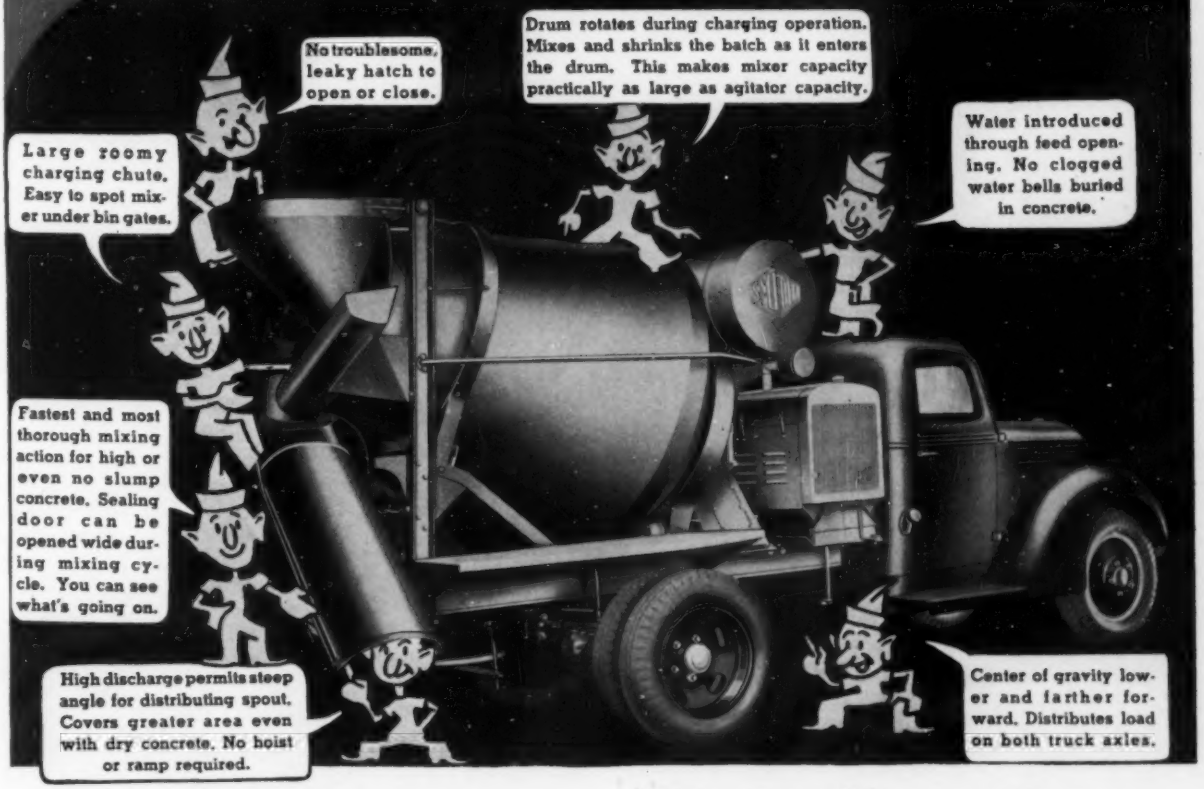
DONALD F. HUNTER, Manager,
2, 3, 4 Cockspur St., S.W. 1, England

Indexed in the Industrial Arts Index. Published Monthly. Subscription Price: United States and Possessions, Mexico, Cuba, Canada, $2.00; and $4.00 to foreign countries. Twenty-five cents for single copies.

To Subscribers—Date on envelope indicates issue with which your subscription expires. In writing to have address changed, give old as well as new address.

Entered as second-class matter, Jan. 30, 1926 at the Chicago, Ill., postoffice, under the Act of March 3, 1879. (PUBLISHED MONTHLY)

Smith-Mobile
and the SEVEN MIXIES!



It's New! *It's Different!*

YEARS AHEAD IN TRUCK MIXER DESIGN

If it's PROFITS you're after — BIGGER PROFITS — then you'll be interested in the new SMITH-MOBILE with the SEVEN MIXIES—acclaimed the fastest, most modern, most practical truck mixer and agitator on the market.

This new machine has turned out to be the sensation of the industry. Engineers and central mix operators everywhere have described the SMITH-MOBILE as the solution of their mixer problems. Enthusiastic endorsements are being backed up by real orders.

The SEVEN MIXIES, shown above, represent EXCLUSIVE SMITH FEATURES. No wonder this new machine has been so universally acclaimed. Altho new in principle, the SMITH-MOBILE has been thoroly field-tested. Built and guaranteed by SMITH — specialists in the manufacture of concrete mixers for more than 38 years . . . Before you buy your next truck mixer, be sure to investigate SMITH-MOBILE.

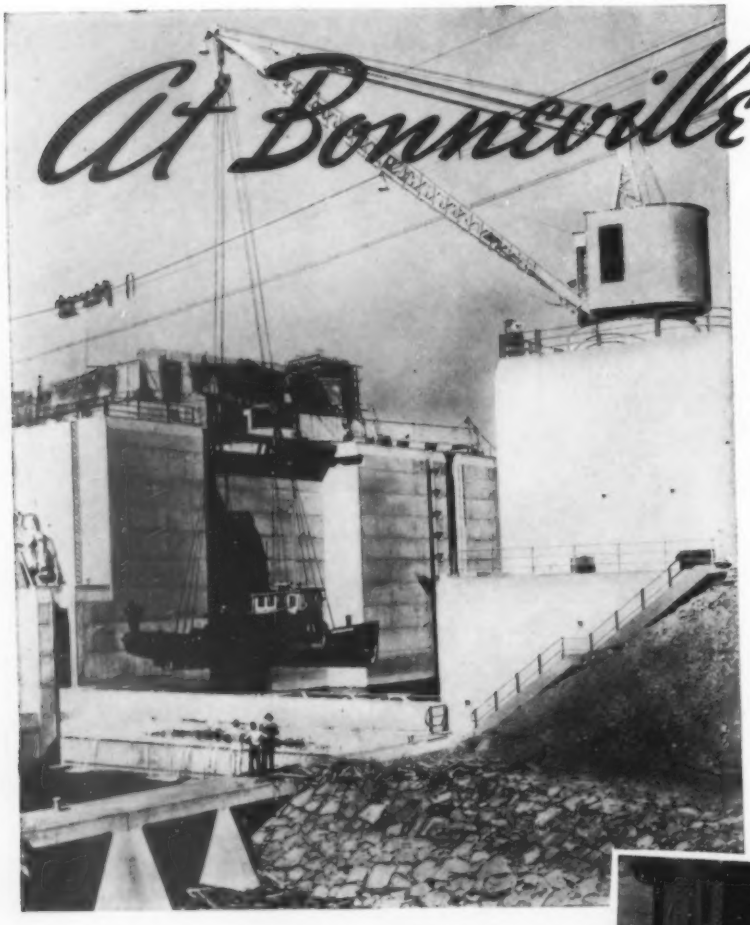
Write now for new bulletin!

THE T. L. SMITH COMPANY
2885 N. 32nd STREET MILWAUKEE, WISCONSIN

SMITH MIXERS
THE BOULDER DAM MIXERS

A2307-1P

At Bonneville Dam...



Crane lifting towboat over temporary bulkhead pending completion of lock which will handle ocean-going vessels.

BONNEVILLE, $52,000,000 development on the Columbia River, called into use equipment of extraordinary size and capacity . . . equipment raising new lubricating problems.

In solving these problems, a number of contractors used Texaco Lubricants. Among them were:

SAM ORINO COMPANY
(Texaco Marfak, Texaco Thuban, Havoline Motor Oil, Texaco Rock Drill Oil, Texaco Crater, Texaco Sultex Cutting Oil, New Texaco Motor Oil.)

D. A. WHITLEY
(Texaco Marfak, Texaco Thuban.)

Trained lubrication engineers are available for consultation on the selection and application of Texaco Industrial Lubricants. Prompt deliveries assured through 2108 warehouse plants throughout the United States. The Texas Company, 135 East 42nd Street, New York City.

Each of the 18 spillways has a pair of these 200-ton control gates. As the result of many tests U. S. Engineers specified Texaco Starfak Grease for lubrication of the Timken-equipped rollers.

View of power house which will have, ultimately, a capacity of 430,000 kw.

Surpassing even the monster Macks at Boulder and San Gabriel, this unit at Bonneville hauls a 35-yard LeTourneau buggy . . . 61 tons, loaded 6 tons at a time by the world's largest dragline. Texaco Marfak is just the thing for chassis and wheel-bearing lubrication under such heavy loads. It outlasts other lubricants 2 to 1.

TEXACO

TEXACO

INDUSTRIAL LUBRICANTS

MORE AND MORE TIMKEN ROCK BIT SAVINGS REPORTED

Many Large and Small Operators Using

TIMKEN Bits

Exclusively

After four years of pioneering the TIMKEN Rock Bit has definitely established itself as the most efficient rock drilling tool ever put into the hands of bit users.

Like all revolutionary kinds of equipment it had the usual battle with tradition, but as one operator after another discovered its tremendous advantages in speed and economy its use spread like wildfire.

Today TIMKEN Rock Bits are being used on some of the largest mine and quarry operations in the country and users constantly report increased savings as they put more and more TIMKEN Bits to work.

These savings come from several sources, namely (1) faster drilling; (2) more footage per bit; (3) elimination of forging; (4) reduction in nipping costs; (5) reduced investment in steels.

You'll never know what you are losing until you try TIMKEN Bits. The sooner you adopt them the less you will lose. Write for name of nearest distributor.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

Manufacturers of TIMKEN Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; TIMKEN Alloy Steels and Carbon and Alloy Seamless Tubing; TIMKEN Rock Bits; and TIMKEN Fuel Injection Equipment.

TIMKEN
ROCK BITS

TRAYLOR

CEMENT EQUIPMENT

During a period of more than two decades, Traylor has won leadership in the manufacture of Rotary Kilns, Coolers, Dryers, Ball and Compartment Mills, for producing Portland cement, and for many other process industries. We have pioneered so many improvements in these units, to solve operators' problems almost as soon as they arose, that a Traylor has come to be known as "tomorrow's machine today".

In recent years we have developed a technique in electric welding, and created special handling equipment to do the work, that enables us to supply still better cement manufacturing machinery than the high quality which we have furnished heretofore.

Our facilities are for the sole use of our good customers, and all cement manufacturers and process industries are invited to use them to the full. Literature and consultation are available immediately, upon request. Write us today, about your problems and needs.

TRAYLOR ENGINEERING & MANUFACTURING CO.
ALLENTOWN, PENNA., U.S.A.

SWING MUSIC FOR MR. ROCHO!

Read this true performance story —

CABLE ADDRESS "DREDGE" TELEPHONE 601

BAY CITY SHOVELS, INC.

BAY CITY, MICHIGAN

April 18, 1938

Engineering News-Record
330 W. 42nd Street
New York, New York

Gentlemen:

We hesitate to refer to performance claimed by BAY CITY owners, particularly as during the past six months BAY CITY owners have told us of performance in terms of yardage which we frankly find it difficult to believe.

Attached is a photo of a BAY CITY Model 20 crane with 3/8-yard clamshell and 35' boom owned by Butler Motor Service, Franklin Grove, Illinois. This machine is shown operating at the gravel plant of Rocho Construction Company at Amboy, Illinois. Rocho was working on a large penalty road job and rented the machine from Butler Motor Service to feed his gravel washing plant. The competitive 3/8-yard machine in the background was unable to handle the daily tonnage required and was taken off the job.

Mr. Rocho, who does not own the machine but was responsible for the job, insists this 3/8 yard BAY CITY machine loaded 110 yards of gravel per hour into his washing plant. This yardage, which amounts to over a thousand yards in ten hours, would be considered excellent performance for a 3/4 or one cubic yard machine.

The speed with which the machine is being operated and the ability of the operator is shown in this action picture where the operator has started to swing back to the gravel pile before the clamshell bucket has completed dumping.

Please prepare an advertisement to feature this performance and run it in an early issue with the enclosed photograph.

Yours very truly,
BAY CITY SHOVELS INC.

MORGAN RAMSAY,
Vice-President.

BAY CITY Model 20-¾-yard crane was the neck of the bottle. . . . Its capacity was the entire plant's capacity . . . so says Stanley E. Bates of Tractor & Equipment Co., who adds: *"Careful, conservative, cautious Mr. Rocho stated that the little Bay City 20 started 110 cu. yds. of gravel through the plant per hour, day in and day out, for several weeks! If any Bay City salesman ever claimed HALF that production to a prospect he would be put down as a colossal liar."*

If you like this swing music see your dealer or write Bay City Shovels, Inc., Bay City, Mich.

Can you Compete without a Loader?

•

It will pay you to investigate the Barber-Greene Bucket Loader.

Just ask for Bulletin 82, there is no obligation.

Also ask for our new 52 page booklet "Good Roads" which shows the complete line of Barber-Greenes for contracting.

•

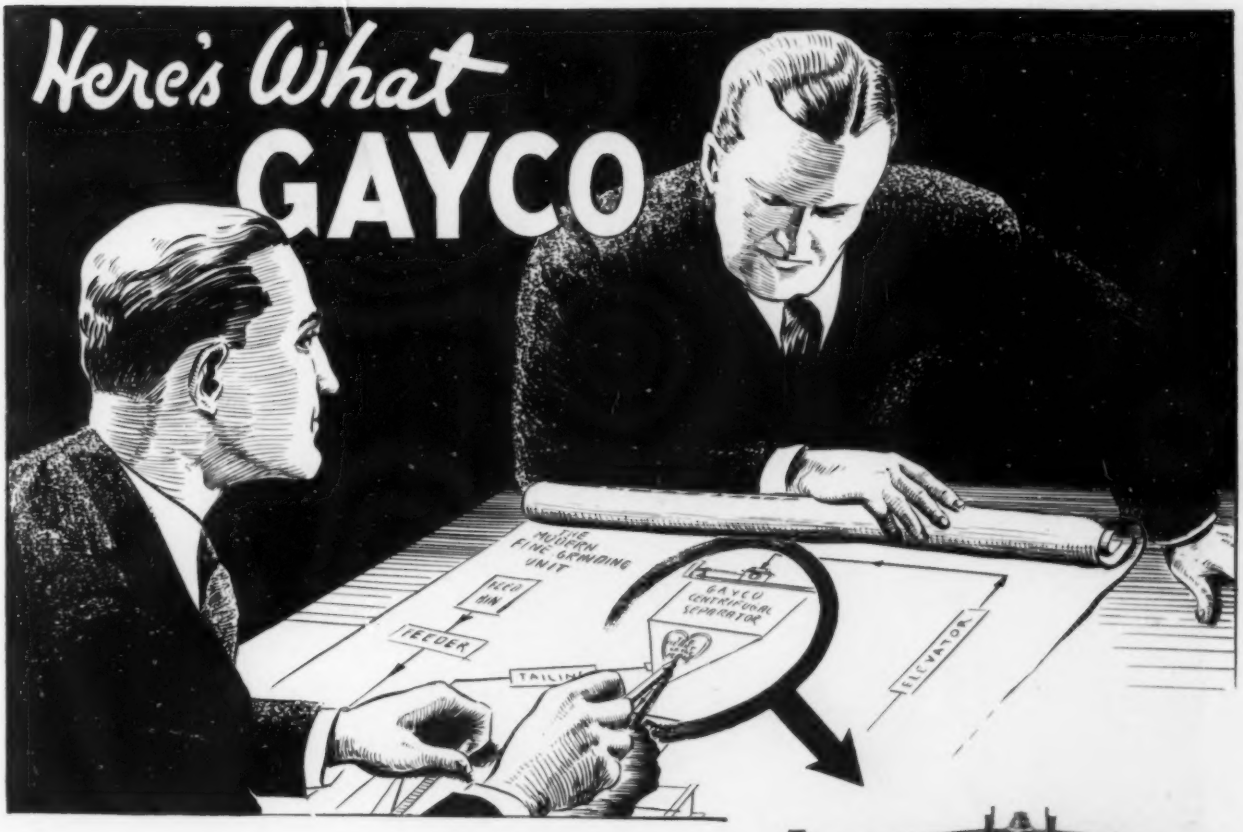
THE primary advantage of the Bucket Loader is simple—it is the cheapest means of loading bulk material. It will probably pay for itself even though you have other equipment now being used for loading. It is generally regarded as one of the most valuable tools for contracting. In addition to low cost, high capacity loading, it is advantageously used for screening, stripping, light excavating, accurate grading, backfilling, etc.

The B-G 82 Bucket Loader is an outstanding achievement in equipment design. Synchronized Feeding gives higher capacity with less power consumption; the Automatic Overload Release protects the machine, eliminates delays; Slow Crowding Speed gives easier, more efficient operation; Fast Traveling Speed saves money and time; Tank Type Chassis Frame gives greater strength, and encloses all driving mechanism; Floating Boom allows crowding thrust to go direct from crawlers to feeding end; the Full Crawler Mounting gives maneuverability that saves time on every move; and the B-G Snow Loader boom can be mounted on the same chassis.

BARBER GREENE

459 W. Park Ave.
Aurora, Ill.

37-8



means to the

CEMENT INDUSTRY

The first GAYCO AIR SEPARATOR revolutionized the cement industry by making possible a material separation previously considered impossible.

The present model GAYCO still leads the industry, representing the very latest improvements in separator design, insuring a more uniform product, greater capacity, cleaner tailings and higher efficiency than is possible with any other Air Separator. It is built to stand up under the most severe usage and give maximum service with low maintenance cost.

Will separate practically all dry fine materials including many that are too sticky to be screened. Easily adjusted for any desired screen analysis from 60 to 400-mesh.

Send for descriptive bulletin today.

Universal Road Machinery Co.

MAIN OFFICE
AND FACTORY
KINGSTON, N. Y.

Canadian Representative
F. H. HOPKINS & CO., Ltd.
346 Canada Cement Bldg.,
Montreal, Que., Can.

GAYCO

RUBERT M. GAY - DIVISION
114 LIBERTY STREET
NEW YORK, N. Y., U. S. A.

GAYCO

"GAYCO" CENTRIFUGAL SEPARATORS

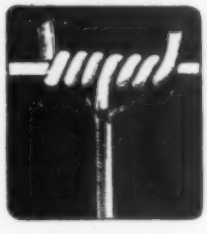
"RELIANCE"
CRUSHING, SCREENING
AND
WASHING EQUIPMENT

An Insensitive Load until you apply the Cap

EASY as using a key . . . for a detonating cap is required to unlock the mighty force of Cordeau-Bickford Detonating Fuse. It is insensitive to ordinary shocks, fire or friction. Its use eliminates the need for caps in the separate charges and reduces the time of loading holes and connecting up preparatory to making the shot.

Though very insensitive, Cordeau explodes with great violence. Extending from top to bottom of each hole, it is in contact with every cartridge, and detonates the charge *throughout its entire length*. The result is greater effectiveness, with consequent savings in material removal costs and better opportunities for profit.

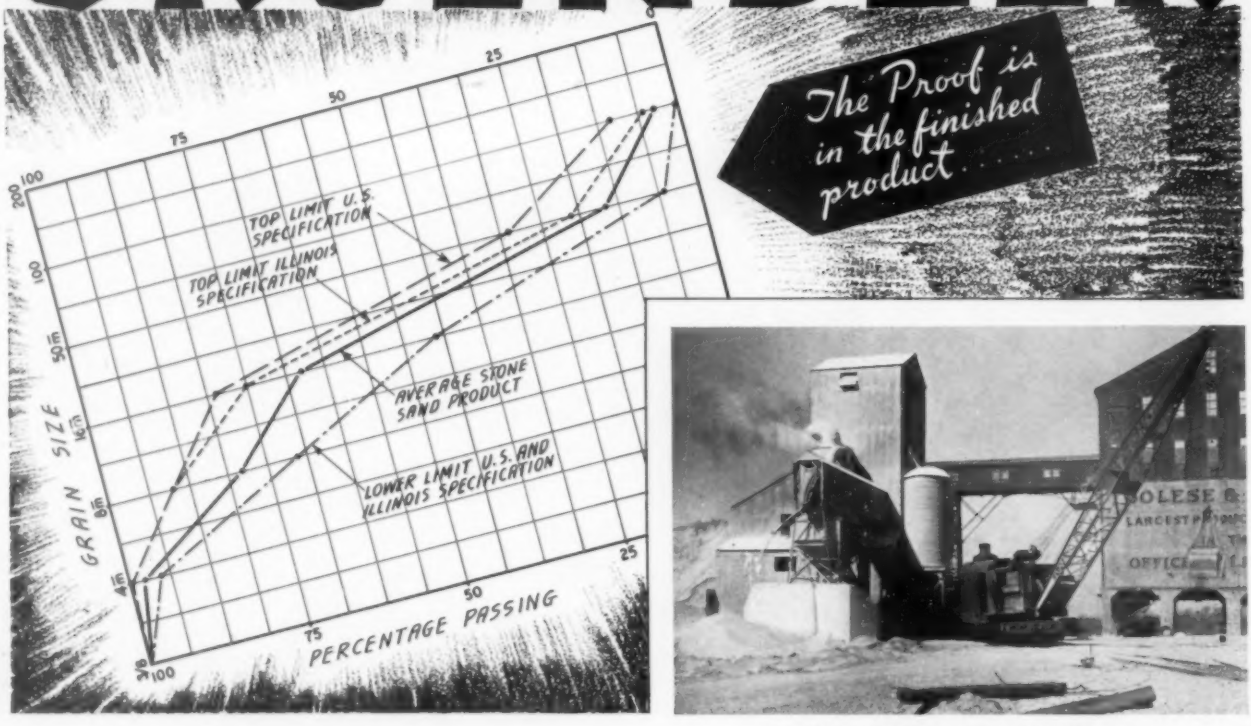
CB73



THE ENSIGN-BICKFORD COMPANY • SIMSBURY • CONN.

CORDEAU·BICKFORD *Detonating Fuse*

GRUENDLER



DOLESE & SHEPARD CO., McCOOK, ILL.

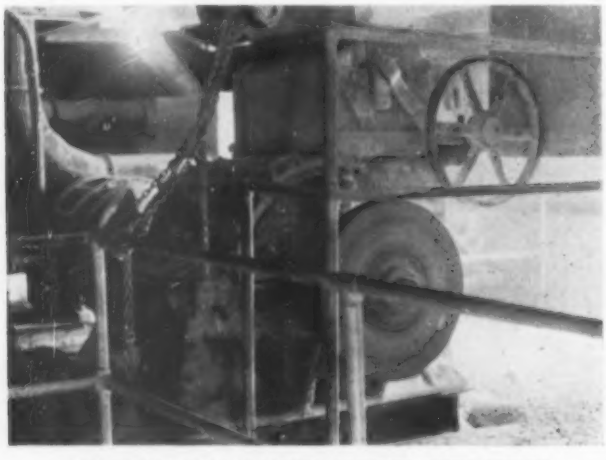
NEW GRUENDLER RING HAMMER CRUSHER MAKES PERFECT STONE SAND

This new Ring Hammer Crusher is the result of fifty-three years of constant effort by Gruendler engineers in perfecting the ring principle of centrifugal impact crushing and pulverizing. The arrangement of grate bars with 1/16-in. openings produces a cubical stone sand product which has been found to be the most desirable shape. Another outstanding quality of the finished product is the absence of slivers or chips.

Note particularly in the chart how easily stone sand made with a Gruendler Ring Hammer Crusher complies with the U. S. and the Illinois specification requirements.

This type of crusher is ideal for crushing coal for mechanical stokers, for limestone, sand, and as a soft stone eliminator in gravel operation. They are designed to produce a uniform product, operate on a low power consumption and yet serve uninterruptedly for years.

Grate Bars, Breaker and Baffler Bars, Shafts, Bearings and Liners all possess individual features of marked superiority which makes both operating and maintenance matters of the strictest economy and satisfaction.



GRUENDLER RING HAMMER CRUSHER WITH FEEDER

Write for Bulletins

GRUENDLER CRUSHER & PULVERIZER CO.

2915-17 NO. MARKET ST., ST. LOUIS, MO.

JAEGERS GIVE YOU *a recognized advantage*

. . . . a Higher Strength, More Workable Concrete, Preferred by Engineers and Contractors . . .

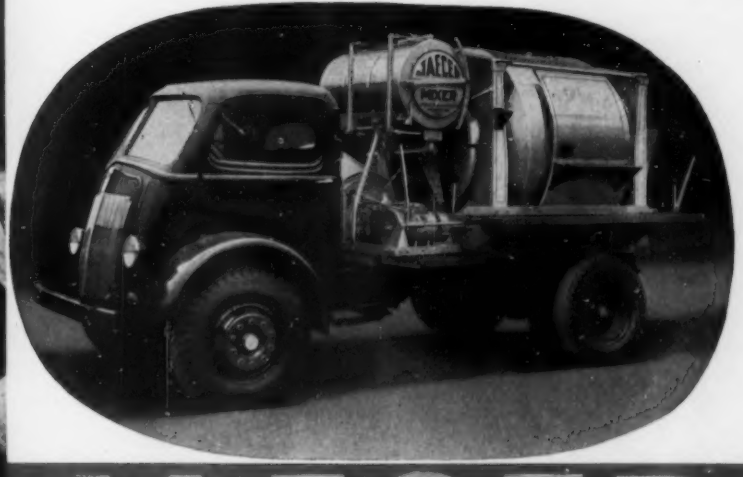
Plus the Most Efficient, Low Cost Mechanism Yet Developed for Transit Mixing and Delivery . .

More concrete is sold by Jaeger Truck Mixers than by any other method—approximately $30,000,000 worth last year —and the demand KEEPS ON GROWING.

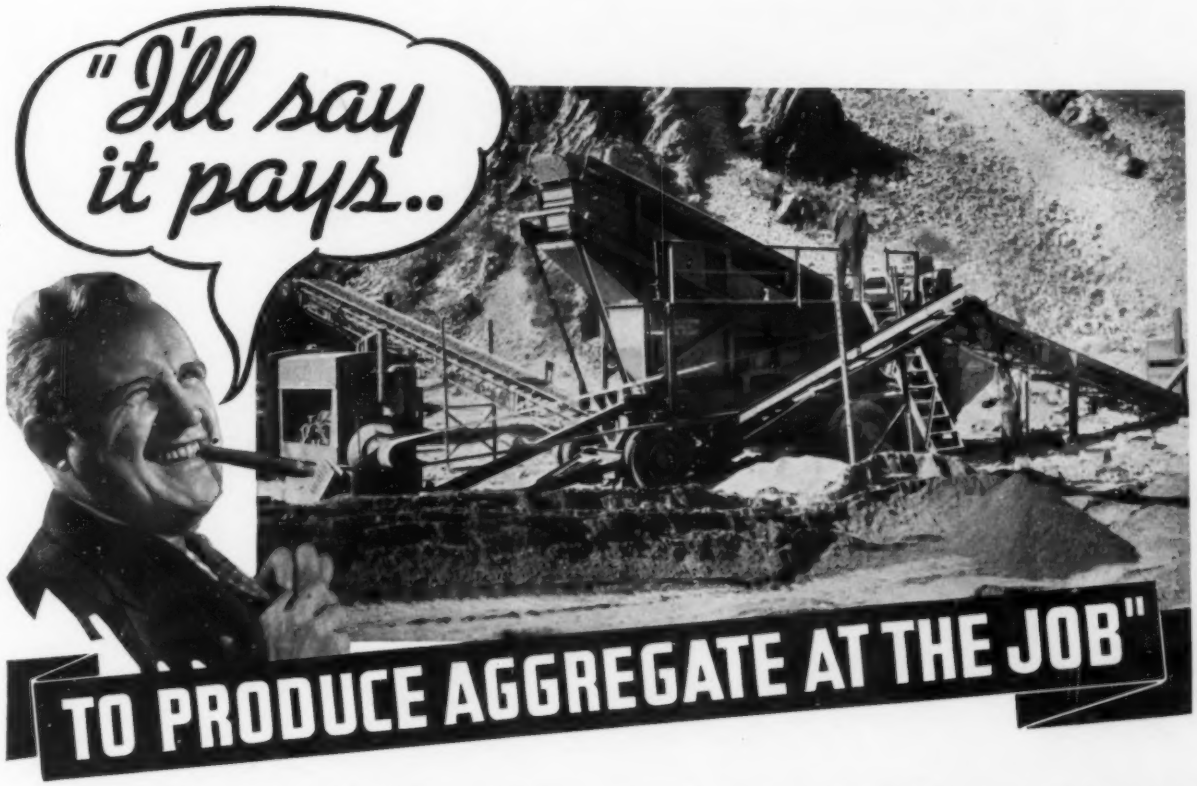
Here is one business that offers opportunity—to make a better profit than you could ever earn by selling bulk materials, to expand your present sales of "ready-mixed," or to establish a new business with the advantage of known quality in your product and greater efficiency in your operating equipment.

Write today for our new Specification TM-37, giving data of essential importance to present and prospective operators of ready-mix plants.

THE JAEGER MACHINE COMPANY
603 Dublin Avenue Columbus, Ohio



JAEGER



. . . report owners of Austin-Western Portable Crushing Plants from coast to coast. Below are three typical reports which prove on-the-job efficiency and economy.

• • • •

"On the 20th day of April, 1937 we took delivery of Model 100 Austin-Western Crushing and Screening Plant. On June 15th we had completed crushing 75,000 tons of gravel 1¼" down with average crush of 35% of total. Our *average crush production* for above was *132 tons per hour*. The only replacement of parts was two sets of jaws. We had no bearing trouble of any description. Since then we have crushed 45,000 tons on three other projects without any trouble whatever. *We consider our Austin-Western Crushing Plant our best money-making piece of equipment.*"

• • • •

"We have owned and operated No. 100 A-W Crushing and Screening Plant for four years and heartily recommend it. It will operate at a minimum upkeep cost and produce a maximum amount of finished aggregate without frequent shutdowns."

• • • •

"Now using our Austin-Western No. 100 for the third year. Very satisfactory handling both gravel and stone. Presently crushing stone to minus one inch, forty-five yards per hour."

• • • •

With an A-W Portable operating as an auxiliary to your fixed plant, sales and profit opportunities are multiplied. Self-contained, readily portable on its own pneumatic tires, this powerful, efficient crusher will deliver volume day-in and day-out from the pit or quarry nearest the job . . . enable you to expand your field of profitable operation and maintain a more balanced business.

Write today for complete details on this powerful, efficient crusher and its nation-wide record as a builder of sales and profits.

AUSTIN•WESTERN

Portable CRUSHING PLANTS

THE AUSTIN-WESTERN ROAD MACHINERY CO.
1844 Barrows Street, Aurora, Illinois

Send full details on:

- ☐ Crushing & Screening Plants
- ☐ Washing Plants
- ☐ Elevating Graders
- ☐ Blade Graders
- ☐ Bituminous Distributors
- ☐ 12-Yard Scraper
- ☐ Shovels and Cranes
- ☐ Motor Sweeper
- ☐ 5-Yard Scraper
- ☐ Motor Grader
- ☐ Trail Cars
- ☐ Roll-A-Plane

CR835

Name_____

Address_____ State_____

City_____

The Popular Choice ★ BLAW-KNOX TRUKMIXERS and Agitators

★ Preferred by contractors, engineers, and users *because:*

. . . they mix concrete faster and more thoroughly.

. . . they produce high strength concrete of maximum workability.

. . . the exclusive Blaw-Knox Water Measuring System is accurate and dependable.

. . . Blaw-Knox Trukmixers are free from breakdowns and delays, insuring continuous dependable service.

. . . they have greater durability due to the use of high quality materials and superiority of design.

. . . ease and speed of operation mean more trips and greater profits.

The desirable and popular features of Blaw-Knox Trukmixers and Agitators are completely illustrated and described in the new Blaw-Knox Catalog No. 1582. *Send for your copy.*

BLAW-KNOX DIVISION
OF BLAW-KNOX COMPANY
Farmers Bank Building • Pittsburgh, Pa.
Offices and Representatives in Principal Cities

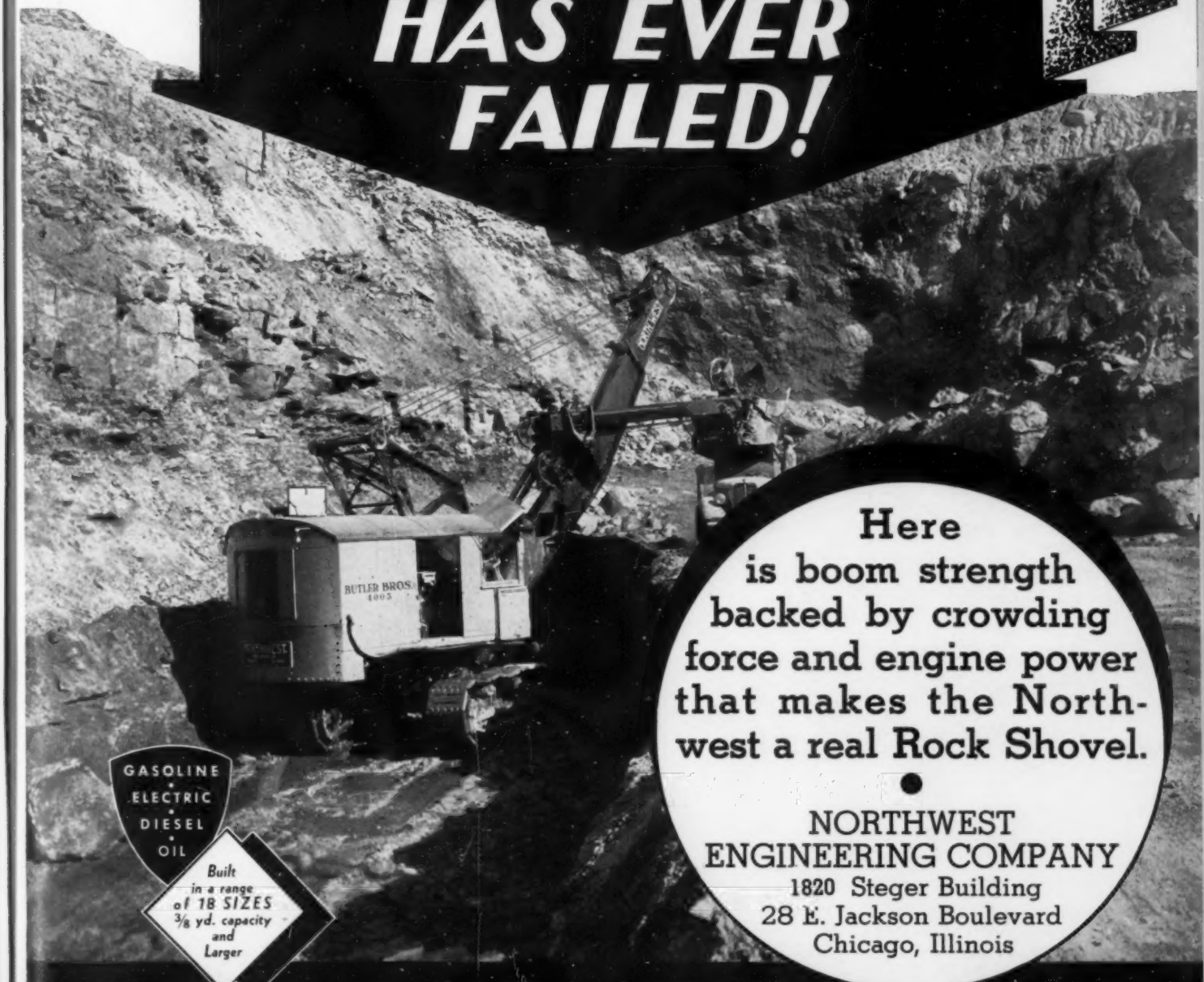
The Reason—

Users Compare the Details and Then Buy

BLAW-KNOX

What Helps Business Helps You!

NO NORTHWEST *Welded* SHOVEL BOOM HAS EVER FAILED!



GASOLINE
ELECTRIC
DIESEL
OIL

Built in a range of 18 SIZES 3/8 yd. capacity and Larger

Here is boom strength backed by crowding force and engine power that makes the Northwest a real Rock Shovel.

NORTHWEST ENGINEERING COMPANY
1820 Steger Building
28 E. Jackson Boulevard
Chicago, Illinois

NORTHWEST

Here's NEWS with a big CASH VALUE

The Brooks LOAD LUGGER

Broadside of truck and Brooks LOAD-LUGGER. Note carefully its simple, compact construction . . . absence of complicated "gadgets", cables, sheaves and hydraulic hose.

Because of its unusual design, made possible by years of precision mechanical design experience of our engineering staff . . . the Brooks LOAD-LUGGER requires no counter-weight on front of trucks. Therefore, the cost of carrying dead weight is completely eliminated. Note that all side-swing is completely eliminated by positive guides on buckets. The entire load is carried on the truck chassis, rather than by suspension.

CUTS HAULING & DUMPING COSTS TO THE BONE

Never before, we believe, has a piece of equipment been produced to equal the Load Lugger, in its field, for production economy. It is practically fool-proof in operation, and, mountable on any truck chassis in a few hours. No sheaves, cables, high-pressure hydraulic hose or "gadgets" are used . . . and consequently no costly replacements. The Load Lugger has a direct drive from power take-off to Hydraulic Pump Hoist, and which, is positive in both up and down motions.

The amazing possibilities of the Brooks Load Lugger in cutting hauling and dumping costs are almost unbelievable. Yet, wherever loading is done by hand, one truck and 5 to 10 Load Lugger buckets may replace an equal number of trucks, depending, to some extent, upon the distance of the haul.

Cash in on the Brooks Load Lugger at once. Write or wire for complete details. Demonstrations arranged.

BROOKS EQUIPMENT AND MFG. CO.
KNOXVILLE • TENNESSEE

Send your Rock Crushing and Pulverizing problems to Brooks Equipment and Mfg. Co., manufacturers of the internationally known DAY "Jaw Type" Rock Crushers, DAY "Swing Hammer" Crushers and DAY Pulverizers . . . a complete line for any desired capacity. DAY Crushers and Pulverizers have been manufactured continuously since 1914 and sold throughout the U.S. and many foreign countries. Complete information furnished on request.

ONE TRUCK WITH A "LITTER OF BODIES"

Hercomite* and Gelamite* will knock out more rock for your money. They'll lay it down so the shovel can eat it up without a halt. They'll whale the daylights out of costs, too. You can get these modern explosives in many strengths and grades to suit all kinds of work. Mail the coupon for the complete story.

*Reg. U. S. Pat. Off. by Hercules Powder Company

HERCULES POWDER COMPANY

Incorporated

1913 - SERVING INDUSTRY - 1938
25th Anniversary Year

A-49

HERCULES POWDER COMPANY
INCORPORATED

946 King Street, Wilmington, Delaware

Please send full information about Hercomite and Gelamite.

Name _____

Company _____

Street _____

City _____ State _____

1. U·S·S LORAIN GRINDING BALLS are forged from new Carnegie-Illinois *Controlled Steel* which has been rolled to predetermined specifications. Experienced workmen with modern laboratory facilities control the chemical analyses and physical properties from the raw material to the finished product, and contribute to the uniformly high quality of these grinding balls.

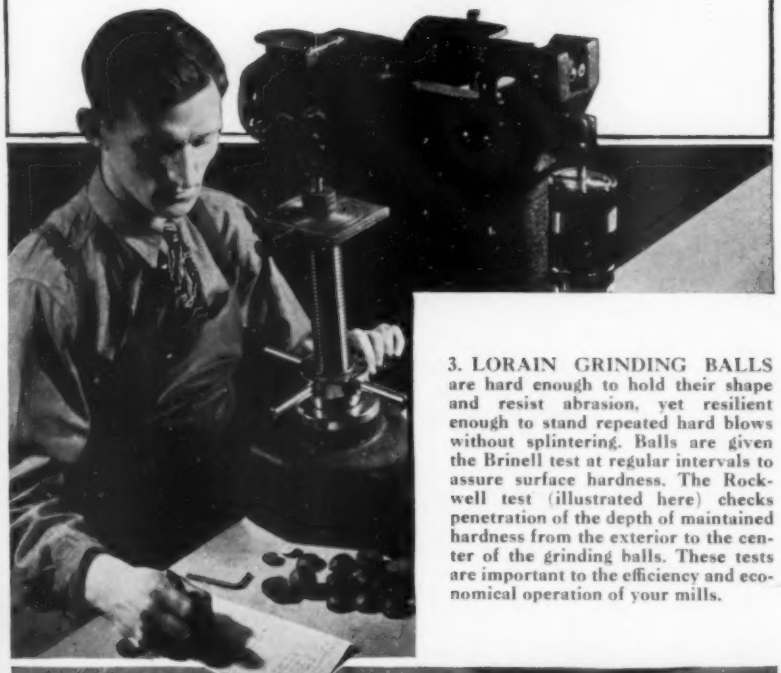
2. CONTROL of heat-treating processes, necessary for correct hardness, is effected by precise timing of movement through the cooling elements, temperatures being charted frequently.

U·S·S Lorain Grinding Balls are available in the following sizes: ½", ⅝", ¾", ⅞", 1", 1¼", 1½", 2", 2½", 3", 3½", 4", 4½", and 5".

OTHER LORAIN PRODUCTS:

Mill Liners and Screens of High Carbon Rolled Plate, Manganese, Chrome Nickel, Chrome Nickel Molybdenum, and plain Carbon Steel or Hard Iron; Hammers for Swing Hammer Mills, Industrial Cars, and Trackwork.

WHY LORAIN GRINDING BALLS LAST LONGER!



3. LORAIN GRINDING BALLS are hard enough to hold their shape and resist abrasion, yet resilient enough to stand repeated hard blows without splintering. Balls are given the Brinell test at regular intervals to assure surface hardness. The Rockwell test (illustrated here) checks penetration of the depth of maintained hardness from the exterior to the center of the grinding balls. These tests are important to the efficiency and economical operation of your mills.

4. AND HERE IS WHERE this care in manufacture and inspection proves its worth. The high grade of carbon steel—uniformity—correct hardness—all contribute to make U·S·S Lorain Grinding Balls the right kind for you—suited to the tough pounding and abrasion of cascade action in your mills.

U·S·S LORAIN GRINDING BALLS

CARNEGIE-ILLINOIS STEEL CORPORATION

Lorain Division, *Johnstown, Pa.*

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*

United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

STURTEVANT

AIR SEPARATORS

Offer these 5 Advantages to the

CEMENT INDUSTRY

1. Controlled Particle Size
2. Controlled Specific Surface Area
3. Increased Mill Capacity
4. Lowered Mill and Product Temperatures
5. Reduced Production Costs

These outstanding advantages have been made possible by the improved design and application based upon research and the practical experience of 240 STURTEVANT AIR SEPARATORS in the Cement Industry.

A STURTEVANT will improve your process from raw stone to finished cement. Their accuracy in selecting the products is amazing, their capacity unequalled and their ability to handle enormous circulating loads is phenomenal.

STURTEVANT AIR SEPARATORS are "standard" for production of "High Early" and regular cement. 1500-3300 S.S. Area.

Built in sizes from 3′ to 18′ in diameter, with capacities from a few hundred pounds to nearly a hundred tons per hour and with a range of 40 to 400 mesh—there is a size to fit your every need.

Now 240 "STURTEVANTS" in the Cement Industry. There must be reasons for this predominance.

STURTEVANT MILL CO.
HARRISON SQUARE
BOSTON, MASS.

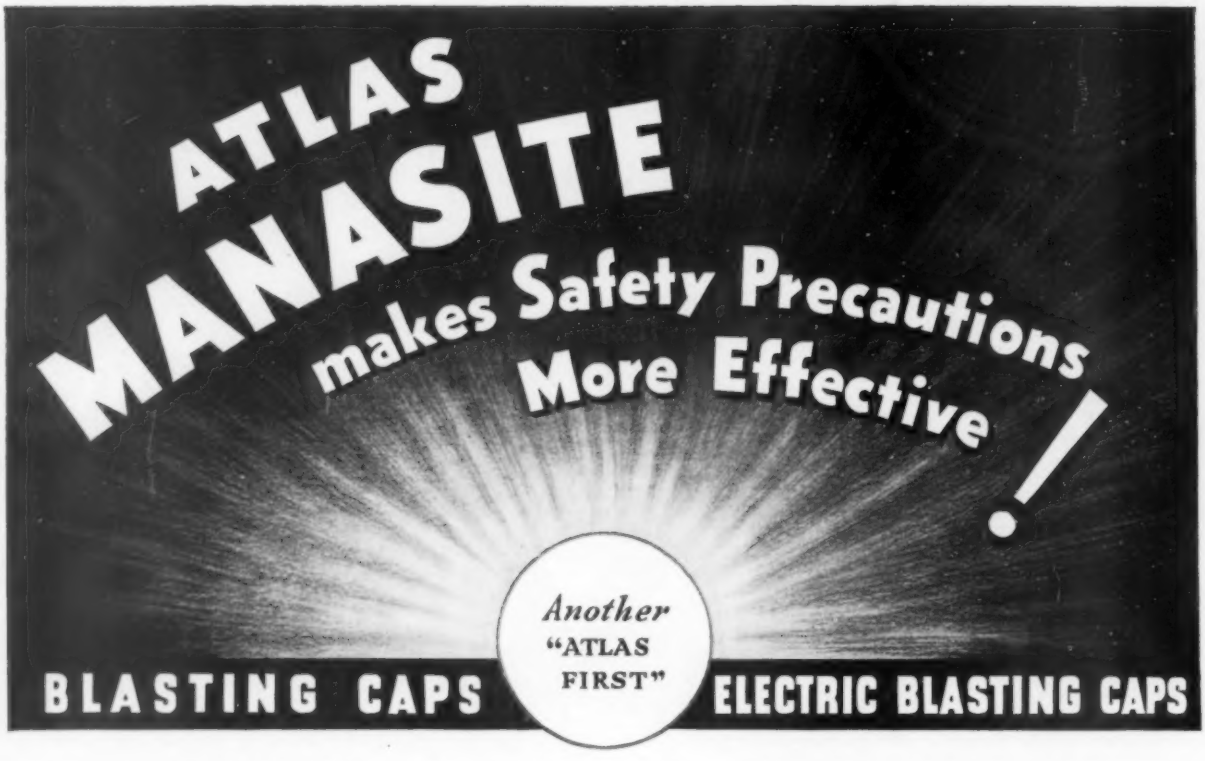
ACCOMPLISHMENT

. . IS BORN OF A DESIRE TO SERVE

It is not being content with things as they are that changed the rambling areas of an earlier time to the concentrated efficiency of the present metropolis . . . cities under one roof, so to speak. ● Neither was it so long ago that power shovels had to be spread out all over the place to accomplish what Marion excavators are doing today with less dimension . . . a minimum of machinery . . . with much more speed . . . greater strength . . . at less operating cost for increased yardage. ● Yes . . . accomplishment IS born of a desire to serve. With Marion, it means maximum yardage at the lowest possible operating cost . . . maximum returns on a sound and proven investment. The Marion Steam Shovel Company, Marion, Ohio. ● ● ●

MARION

EXCAVATORS



With the introduction of the new Atlas Manasite Blasting Caps and Electric Blasting Caps, safety precautions in blasting operations become more effective than ever.

Any operation in blasting practice demands rigid maintenance of safety precautions, but Atlas Manasite Detonators widen materially the margin of safety by lessening the possibility of accident from inadvertent mishandling.

Through an exclusive, patented Atlas method of using nitro-mannite as an initiating compound, Atlas Manasite Detonators indicate a substantial reduction in sensitivity to impact and friction—but possess full detonating efficiency.

Careful tests—the falling weight test, the sand friction test, the piercing test, heat and flash tests—have indicated a much greater margin of safety than is possible with ordinary detonators.

With Atlas Manasite Blasting Caps and Electric Blasting Caps, there is greater safety in handling for the worker with explosives, and far less chance of accident through handling by irresponsible people.

ATLAS POWDER COMPANY, WILMINGTON, DEL.

Cable Address—Atpowco

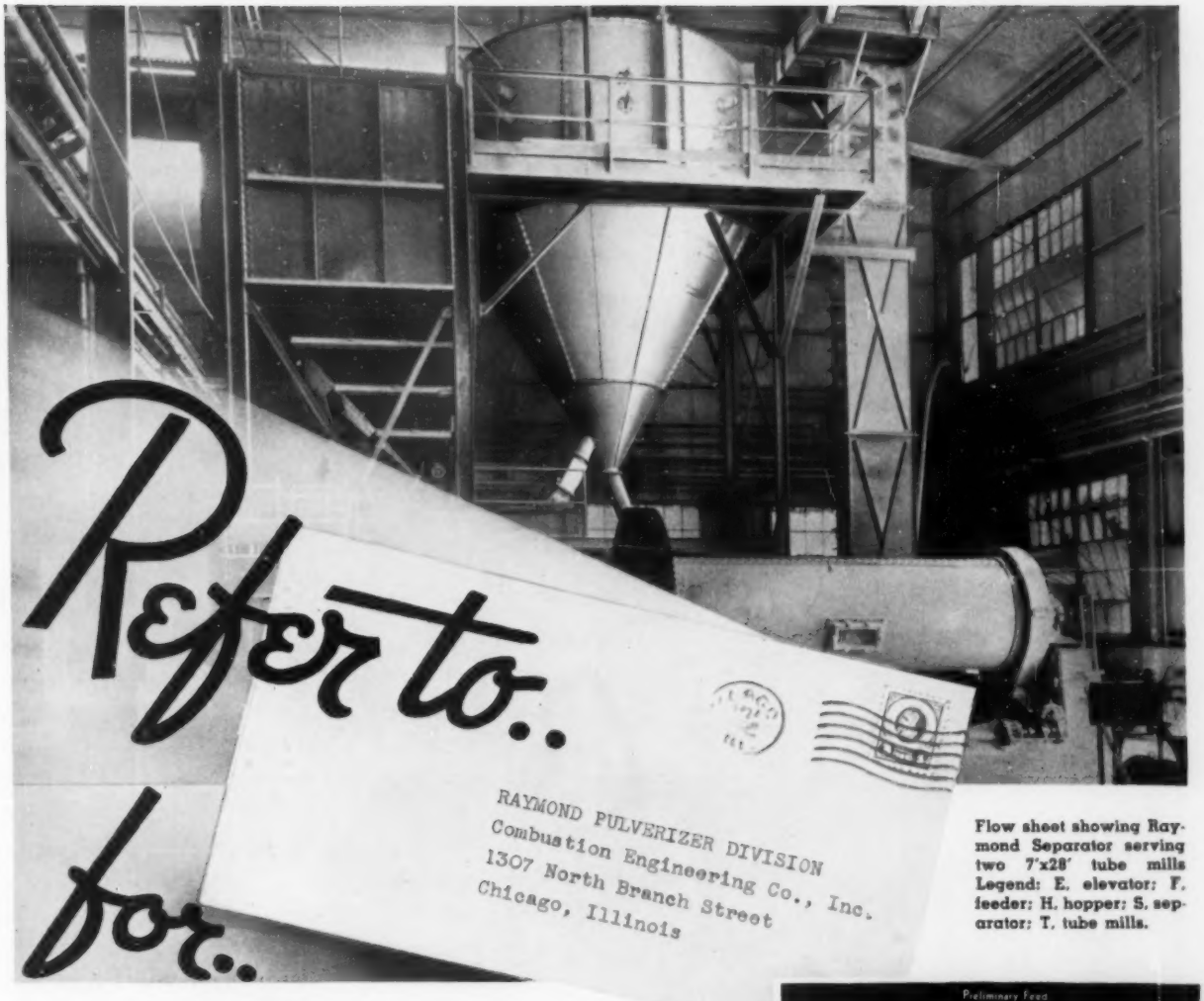
Everything for Blasting

OFFICES

Allentown, Pa.	Houghton, Mich.	Memphis, Tenn.	Pittsburg, Kansas	Seattle, Wash.
Boston, Mass.	Joplin, Mo.	New Orleans, La.	Pittsburgh, Pa.	Spokane, Wash.
Butte, Mont.	Kansas City, Mo.	New York, N. Y.	Portland, Oregon	St. Louis, Mo.
Chicago, Ill.	Knoxville, Tenn.	Philadelphia, Pa.	Salt Lake City, Utah	Tamaqua, Pa.
Denver, Colo.	Los Angeles, Calif.	Picher, Okla.	San Francisco, Calif.	Wilkes-Barre, Pa.

ATLAS
EXPLOSIVES

CHEMICALS ATLAS EXPLOSIVES



Flow sheet showing Raymond Separator serving two 7'x28' tube mills Legend: E, elevator; F, feeder; H, hopper; S, separator; T, tube mills.

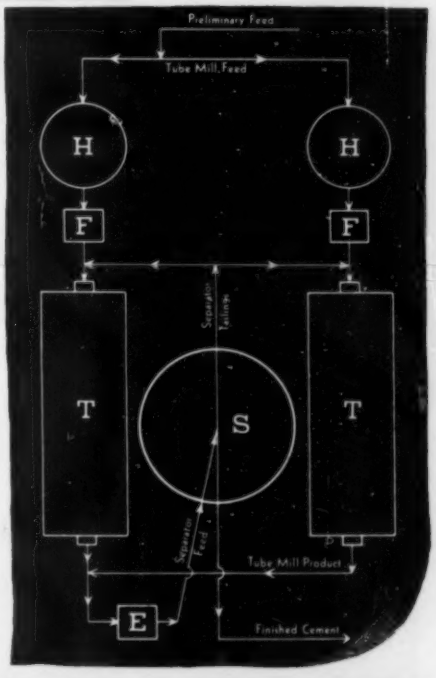
CEMENT Separating Problems

WHEN making standard and "high early" cements, your production problems will be simplified if you use the **double whizzer type** Raymond Mechanical Air Separator. Here are some notable results from a recent installation:

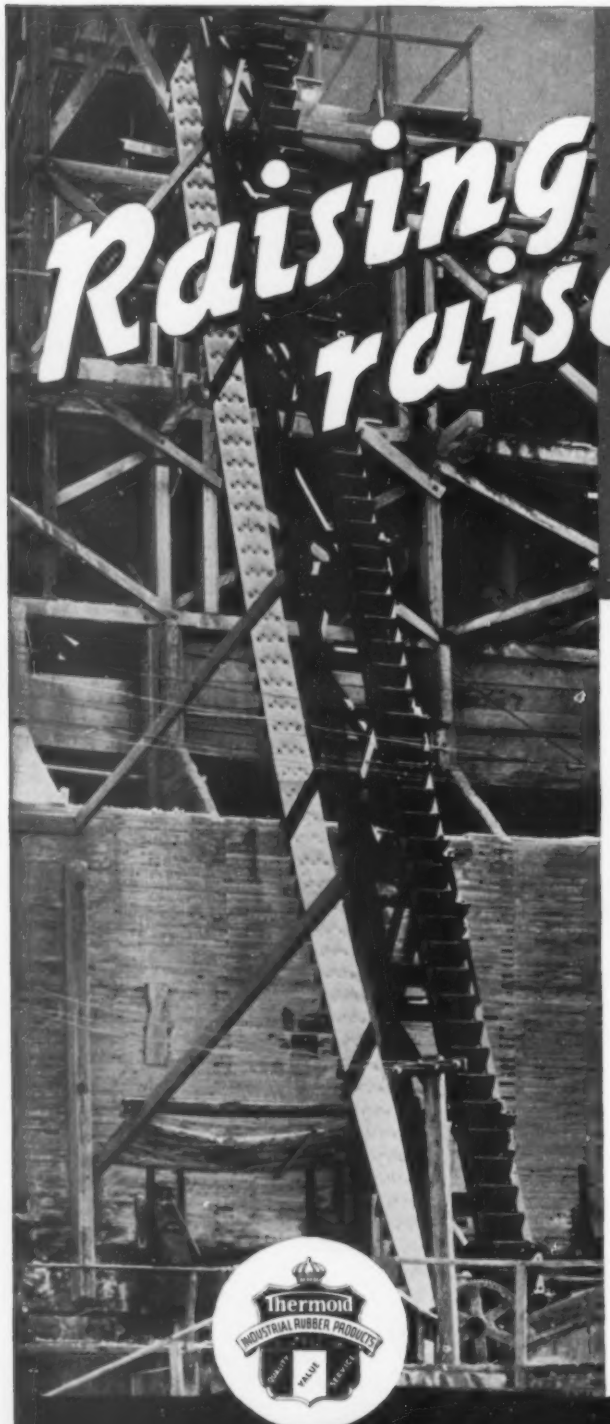
STANDARD CEMENT: With the Raymond Separator in closed circuit with two tube mills, an output of 190 to 210 bbl. per hour is produced at 1800 surface area. This is better fineness and greater capacity than obtained in open circuit grinding, which averaged only about 1530 surface area at 180 bbl. per hour.

HIGH EARLY STRENGTH CEMENT: In changing to this grade, the operator simply adjusts the exterior control slides on the Separator and uses a finer preliminary feed. The Raymond Separator produces 84 bbl. per hour of finished material, testing 2860 surface area, and showing a tensile strength of 342 for 1-day, 432 for 3-day and 517 for 7-day cement. Previously, this plant was unable to produce the high early cement without the Raymond Separator.

You will find it easy to meet today's rigid cement specifications with the Raymond **double whizzer** Separator. Write for details.



Sales Offices in Principal Cities • • • In Canada: Combustion Engineering Corporation, Ltd., Montreal



Raising Rock raises "Cain"

WITH BUCKET ELEVATOR BELTING

And Thermoid knows where the "Cain" (or strain) tells first. Thermoid engineers have stumbled over their own air drill hose and dodged many a shower of blasted rock to *get the facts*—to see the job this belting is expected to do.

Whether the load is dust or crushed rock, there is a Thermoid Bucket Elevator Belting built for the job. That's because our engineers and laboratory men have developed (1) a special silver duck that can withstand the strain of bucket *plus load* right at the bolt holes; (2) a fabric that gives maximum resistance to sudden surging loads; (3) a carefully compounded and tested rubber impregnation and cushion between plies that can stand up under the severest service conditions.

Thermoid Bucket Elevator Belting proves its superiority in the way that counts most —by delivering the lowest cost per foot per service hour.

Thermoid

THERMOID RUBBER
Division of Thermoid Company
TRENTON, NEW JERSEY

BELTING · HOSE · PACKINGS · BRAKE LININGS

"NO THREE-DAY LAYOFFS FOR THIS TRUCK—

Here's Why"

OWNERS' records show that Ford V-8 Trucks do more work, in less time, at lower cost. And they can keep up the good work without a layoff, when repairs finally become necessary. The Ford Engine and Parts Exchange Plan sees to that.

Under this plan, operators of Ford V-8 Trucks and Commercial Cars can enjoy new engine performance, without sacrificing working time, by simply exchanging an engine that has given many thousands of miles of hard service for a factory-reconditioned engine. The exchange takes only a few hours, instead of a few days, and can be accomplished after a truck's working day is over — at a cost lower than the ordinary engine overhaul.

Other reconditioned parts that are available at low cost include carburetor assemblies, fuel pump assemblies, generator assemblies, generator armatures, distributor assemblies, clutch pressure plate assemblies, clutch disc assemblies, brake shoe assemblies and shock absorbers.

This maintenance plan is one of three money-saving features enjoyed by all operators of Ford units. The other two, of course, are low first cost, and low operating cost.

Ford

SEE A FORD DEALER TODAY FOR AN "ON-THE-JOB" TEST

FORD V·8 TRUCKS AND COMMERCIAL CARS

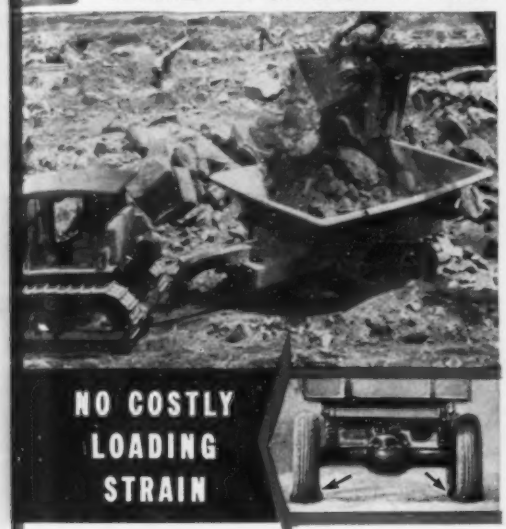
YOU ESCAPE THESE HIDDEN HAULING COSTS

WITH

ATHEY FORGED-TRAK WAGONS & TRAILERS

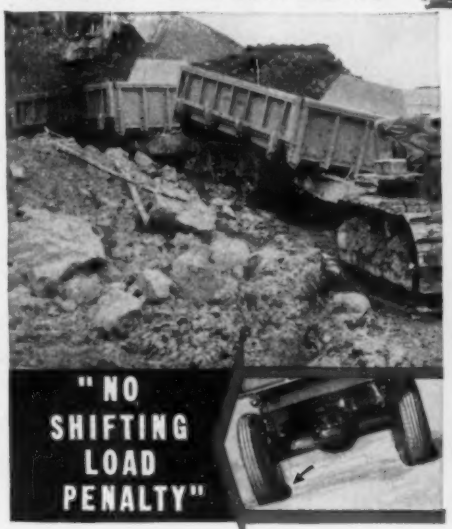
If you are looking for hauling equipment that will [illegible] your present hauling cost and overcome [illegible] ing hazards, turn to Athey Forged-Trak Hauling Units pulled by "Caterpillar" Diesel Tractors. [illegible] the *proved* way to speed up work and save money. See your "Caterpillar" Dealer or write us.

ATHEY TRUSS WHEEL CO., 5631 West 65th Street, Chicago, Illinois. Cable Address "Trusswheel," Chicago.



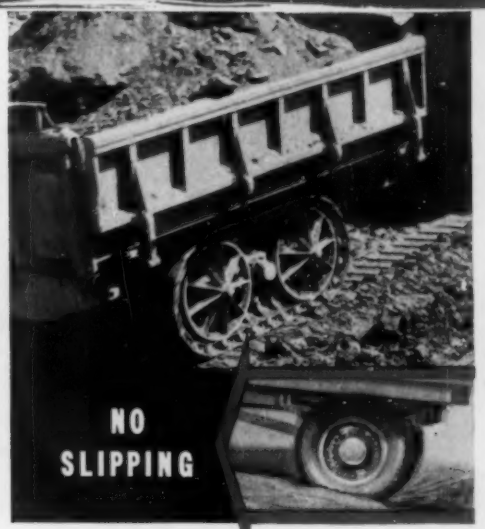
NO COSTLY LOADING STRAIN

Great weight dropped by the loader carries a tremendous impact to tires—results in high tire costs. Athey Forged-Trak Units *absorb* the overload caused by impacts of loading. Their double husky bodies, too, can "take it."



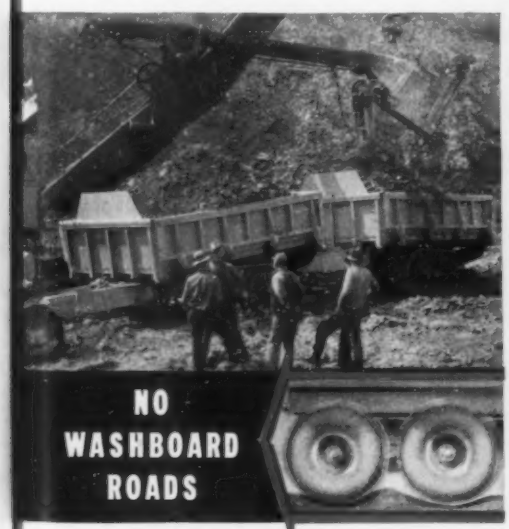
"NO SHIFTING LOAD PENALTY"

Uneven roadways result in shifting loads that cause early tire blow-outs and heavy replacement costs. With Athey Forged-Trak Units, steel wheels rolling over steel rails on a self-laying bed of steel, take care of road inequalities.



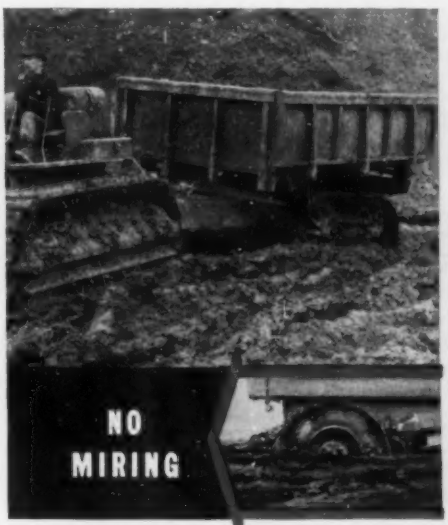
NO SLIPPING

Slippage of round wheels on gravel, wet clay, loose stone, or slippery surfaces, or on bumpy, rutted or uneven haul roads means greater wear and tear on equipment and tires. The track-type principle of Athey Forged-Trak Dump Trailers reduces slippage to a minimum.



NO WASHBOARD ROADS

"Washboard" roads hammer the life out of heavily loaded rubber tires . . . set up vibration of the equipment that results in breakage and rapid deterioration. Washboard roads *do not exist* for Athey Forged-Trak Wheels.



NO MIRING

Athey Forged-Trak Wheels—self-cleaning—have a solid, contact area far greater in weight-supporting ability than dual or any practicable multiplicity of round wheels. They do not slip, spin or dig ruts. Their broad tracks tamp the surface; build up the road base.

NO SPILL HAZARDS

Excessive spill causes difficulty in moving the loaded truck from under the loader, and frequently necessitates cleaning up the spill. The husky, rigid frames and three-point spring suspension of Athey Units eliminate the hazards to hauling equipment under the loader.

ATHEY FORGED-TRAK (REG. TRADE MARK)

ATHEY

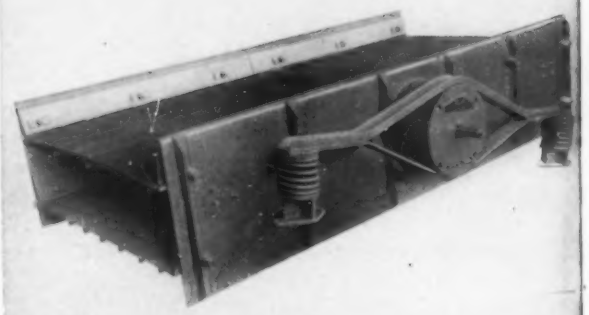
WAGONS & TRAILERS

SCREENS

GYREX

FOR COARSE SCREENING

VIBREX



FOR FINE SCREENING

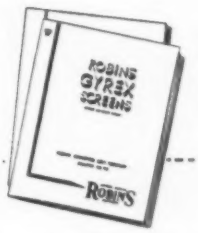
The screen must fit the job to be done if the user is to enjoy the full benefits of modern screen design. That is why Robins has developed two distinct types of screens . . . GYREX and VIBREX . . . in more than three hundred sizes, styles and models. The Robins engineer who calls on you can therefore be impartial, he has a complete line from which to select a screen that exactly fits your work. Ask his advice.

Robins also builds, for the aggregates industries, dependable belt conveyors and a host of other material-handling units as well as complete systems.

EQUIPMENT ITEMS

Belt Conveyors
Elevators
Idlers
Belt Trainers
Belts
Trippers
Feeders
Gates

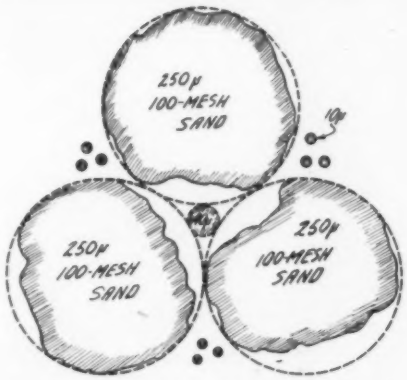
MATERIAL HANDLING
ROBINS
EQUIPMENT



ROBINS CONVEYING BELT COMPANY,
15 Park Row, New York, N. Y.
Please send me literature about.....
Please have representative call.....
Name .....
Firm .....
Address .....
City .....*State* .....

Rock Products

Vol. 41 Chicago, June, 1938 No. 6



Cement—For What?

Assume It Is To Bind Graded Particles of Minerals Together

RESEARCH has thrown much light on the constitution of various portland cements, and many and varying conclusions have been drawn therefrom; but the fact still remains that if horse manure could be processed to make a *permanent* mineral binder, horse manure cement would be just as acceptable as cements made of limestone and clay. And in spite of much literature to the contrary, the development of portland cement has been anything but an orderly and regular process. Both users and manufacturers have been stampeded first one way and then another; manufacturers, it must be admitted, often unwillingly.

Just now the industry is suffering from a magnesia phobia, although only a few years ago there was a wealth of authority to the effect that magnesia up to 7.5 or 8 percent was not only harmless, but possibly beneficial. We do not attempt to dispute that magnesia in portland cement as it is at present manufactured may be exceedingly harmful. But excellent natural cements and some portland cements high in magnesia have been made. It may be that higher kiln temperatures and higher limed mixtures have made magnesia harmful, but such changes in operating practice are not considered in the general condemnation of magnesia. That is only one example of a failure to tie many loose ends together in an attempt to find a cement that will make good concrete, rather than to find a cement that of itself alone will have a certain chemical character or certain physical properties.

The virtue of the early natural cements was that they were burned at relatively low temperatures. The makers knew that the desirable combinations of lime and magnesia and silica and alumina were not helped but retarded by too high temperatures. We know also, from experience in making artificial puzzolanas, that too hard burning of the clay or silicious materials is worse than not enough. But in modern rotary kiln practice we certainly give the clay and silicious materials a hard burning before they reach the clinkering zone. Who knows that we would not get better results if the clay and silica were introduced lower in the kiln before they were hard burned? As it is, we are making a combination of hard burned lime and hard burned argillacious materials, when we know that hard burning them individually makes them relatively inert toward each other in the presence of water.

Another present phobia is extremely fine grinding. It must, of course, be granted that fine grinding makes for a quicker hardening cement. Some experts are so sure of the product that they now are interested only in results of 1-day and 7-day tests. It seems to us that if concrete is to fulfill its mission on earth these users ought to be more interested in its 7-year strength, or its integrity at the end of say 20 years.

It also seems to us that if we are going to grind cement to 40 microns, we will have to (1) find something to fill the gap between 40-micron cement particles and 100-mesh sand; and (2) we'll have to find a mechanical means of coating 100-mesh, 200-mesh and 300-mesh particles of sand or fine aggregate with this colloidal silicate gel we think is called portland cement. Incidentally, this colloidal or amorphous silicate gel is something which reacts on wetting and drying very much like a living thing. Too large gobs of it with no intervening aggregate evidently would not make good concrete.

We are told that the coarse particles of dicalcium silicate never hydrate except at the surface. That's the only place we want them to hydrate. Then if these particles are so graded as to give the densest possible packing we'll get a dense mortar between the fine aggregate particles, with sufficient but little excess of silicate gel. We fail to see the argument that cement must be extremely fine ground to be useful as cement, and we confidently believe that when *permanence* of concrete is a larger factor than quick-hardening, we will put more emphasis on ideally graded cement—proper size distribution—than on mere fineness or on high tricalcium silicate content.

Nathan C. Rockwood

A So-Called "Yardstick" Plant

U. S. MAKES PORTLAND CEMENT

By HERBERT H. LAUER

IT WILL NO DOUBT be interesting to many to obtain a brief description of the Island and its people and the reasons for the building indirectly by the United States Government of a cement plant in Puerto Rico.

The Island is practically a rectangle about 36 miles in width and a hundred miles in length or approximately 3500 square miles in area. The seacoast is level but the interior is mountainous, ranging in elevations from a thousand to four thousand feet above sea level. A large part of the Island has been a coral limestone up-lift, which is very high grade limestone. Then, there have been intrusions of volcanic rocks, syenites, andesites, rhyolites, and intermixed with volcanic ash. Some of the rocks have broken down into silicious clays both with high and low content of silica.

The population of the Island is about 1,800,000, or about 500 per square mile, about twelve times as dense as the population of the United States and is increasing at the rate of 40,000 persons per year. Most of the population is concentrated on a narrow coastal plain.

A large part of the fertile land is occupied by sugar plantations and only a small portion is being used for the raising of food for the inhabitants, and large amounts of food supplies such as beans, rice, grain, etc., are imported.

The sugar mills are the main industry so that the working population is largely agricultural. Attempts have been made to develop other industries without much success, for the Island's mineral resources are meagre. About 300,000 of the population are unemployed. The common labor rate varies from 50c to 60c in the country to $1.25 per eight-hour day in the larger towns —an 8-hr. day was established by law in 1935.

THE AUTHOR, a well-known operating man in the American cement industry, was superintendent of construction of the Puerto Rico plant described here. Production of cement was to start the latter part of May, or about the time this article goes to press. Mr. Lauer returned to the United States last winter and is now a consulting cement plant engineer, Philadelphia, Penn.

—The Editor.

Source of Materials Surveyed

The investigation of the raw materials for cement manufacture was made by Maj. Edwin C. Eckel, chief geologist of the Tennessee Valley Authority, and his staff.

Construction view of Puerto Rico cement plant, showing slurry mixing basin and storage tanks, finished cement tanks, kiln, grinding mills and clinker cooler

Three sites were investigated, one near San Juan, the capital of Puerto Rico, one at Aguadilla in the western part of the Island, and one near Ponce in the southern part and the second largest city in Puerto Rico.

Limestone and clay in large quantities are found at Catano near San Juan, and as 70 percent of the cement demand is developed in this area, the plant was located there.

Aguadilla had some high magnesia rock intermingled with the limestone and the clay was some ten miles away from the proposed quarry.

The Ponce site had plenty of high grade limestone but practically no clay of any kind. Hence it was finally decided to locate the plant at Catano on account of: (1) an ample supply of limestone and clay; (2) demand for cement about 70 percent of the market; (3) a larger supply of labor with construction and industrial experience.

The cement demand for Puerto Rico has varied from 320,000 to 450,000 bbl. per year; hence a 1000-bbl. per day unit or 350,000 bbl. per year was selected, being designed so that its capacity could be doubled in case the requirements of the construction on the Island demanded such a plant.

The plant site selected is located at the foot of coral limestone hills, which are about 300 ft. in height, and is connected with the American Railroad of Puerto Rico, a meter-gage line, by a single-track spur that is 4400 ft. in length. Empty cars are set in back of the pack-house on a ¾ of 1 percent down grade to the pack-house and beyond it for a sufficient length to handle the day's shipments.

Three contracts were let to the M. A. Long Co., of Baltimore, Md.: (1) Principal machinery, kilns, mills, pumps, motors, switchboard, compressors, etc.; (2) heavy foundations, kiln and mill piers, slurry tanks and basins, limestone clinker and gypsum storage building; (3) structural steel buildings and concrete mill and kiln-feed-end building, concrete stack, finished-cement-storage bins, substation transformers, 50,000-gal. concrete water tank, etc.

The fourth contract, let to the Viking Construction Co., of New York, included a 10,000-bbl. oil storage tank, all piping, electrical wiring, quarry cars

A birds-eye view of the new cement plant built by the United States Government on the Island of Puerto Rico at Catano, near San Juan. It is a wet process plant with a capacity of 350,000 bbl. per year

and locomotive, in fact the balance of the plant equipment including machine shop and storeroom equipment, plumbing, sewers and drains, etc.

The contract for the railroad spur track, and the plant office was let to Manuel Miro, a Puerto Rican contractor. The deep-well pump and pump house contract was let to Luis Antosanti, contractor, Ponce, Puerto Rico.

The total cost of the plant is approximately $1,400,000, or $4.00 per bbl. of yearly production, which is high; but the plant is a small one and is designed to resist hurricanes of 150 miles per hour, which added very considerably to the cost.

Estimated Demand

Foreign and United States cement have been imported. The United States cement sold has never exceeded 200,000 bbl. in any year, the balance being supplied by German, Danish, and Belgium companies. American manufactured cement has been selling from $2.25 to $2.40 per bbl. f.o.b. the dock. The German and other foreign cements have been selling for about $1.60 per bbl. It was figured that the new plant, properly and efficiently managed, could produce cement on cars or trucks, including a low rate of interest and return of the investment in 30 years, for about one dollar less than the United States cement price. This is based on full operation of the plant throughout the year with a shutdown period for repairs of about two weeks only.

It was figured that the demands of the federal government, the insular government and Puerto Rico Reconstruction Administration would require a total of 1,000,000 bbl. in the three years after the plant was built. On the basis of the plant being able to produce cement for about one dollar a barrel cheaper than the United States manufactured cement, the greater portion of the investment would be saved in the first three years of operation.

Plant Details

The plant has an F. L. Smidth & Co. modern kiln, 7 ft. 6 in. in diameter by 306 ft. in length, with an enlarged burning zone 8 ft. 6 in. in diameter. The kiln is supported by five tires and has the F. L. S. Unax clinker cooler at the discharge end. It is guaranteed to produce 1100 bbl. of clinker per day of 24 hours at 1,000,000 B.t.u. per bbl., when burning oil of 18,500 B.t.u. per lb., and slurry of a moisture content of 34 percent. This guarantee varies with the increase in the moisture in the slurry and the decrease in the B.t.u. content of the oil.

There are two F.L.S. Unidan mills, 7-ft. 3-in. in diameter by 29 ft. in length, guaranteed for 62 bbl. per hour raw material, and 65 bbl. per hour finished cement. One is a raw mill and one the finish mill. Except in minor details they are duplicates. Each mill is driven by 600-hp. Electrical Machinery Manufacturing Co., 2300-volt, 3-phase, 60-cycle, synchronous motors.

The slurry from the raw mills is pumped to the slurry tank by either one of two duplicate 4-in. Wilfley pumps. The finished cement is pumped to the cement silos by either one of two 6-in. Fuller-Kinyon cement pumps driven by 40-hp., 1200-r.p.m. motors.

The raw and finish mills are located side by side in the mill room, together with a fifteen panel switchboard for control of the entire plant, and a Hall-Scott gasoline engine driven, emergency power unit of 132 hp. to operate the kiln, lights, etc., in case of a main-line power shutdown, motor generator sets and three Fuller Co. rotary compressors, two of 40 p.s.i. for slurry agitation and for operation of the Fuller-Kinyon pumps, and one of 100 p.s.i. pressure for the quarry operation and general plant use; a total of 1500 cu. ft. per min. The mill room contains the main control of the plant and is in a very heavily reinforced-concrete building, built to resist hurricanes and heavy storms.

CONSTRUCTION of the Puerto Rico plant by the U. S. Government was opposed by the Cement Institute. Reasons were given why the government should not build this plant. These objections were endorsed by Maj. Charles F. Lewis, in private life, manager of the Volunteer Portland Cement Co. Subsequently, Maj. Lewis, convinced of the justification for the plant by existing social and economic conditions in Puerto Rico, agreed to serve as consulting engineer.

—The Editor.


PRESENT DRAIN
OFFICE AND LABORATORY
PRESENT SEPTIC TANK
6" T.C. CONNECT TO PRESENT DRAIN
CONCRETE PIER SUPPORTS FOR PIPE - PIERS 14 C TO C
2" STEAM LINE NOTE 5" OIL LINE ABOVE STEAM LINE
OVER HEAD PIPE SUPPORTS
CLINKER ELEV
PRIMARY AIR BLOWER
NEW SEPTIC TANK
PREHEATER AIR TUBE
PRIMARY AIR TUBE
CLINKER CONV
6" T.C. SOIL PIPE
TO SPILLWAY
12" T.C. DRAIN PIPE
MH
OIL STORAGE
CEMENT STORAGE BINS
CLINKER COOLER
AIR REC
AIR REC
2 H.P. AIR
STORE ROOM
1000 GAL MAIN GASOLINE TANK
MILL
PACK HOUSE & BAG STORAGE
MACHINE SHOP
CB
6" T.C. SOIL PIPE
PUMP HOUSE
KILN DRIVE HD
KILN
35'
PROPOSED ROAD
PROPERTY LINE
FIRE HYDRANT
STRIKE
RAILROAD
PUMP HOUSE
MH
CB
ELEC M.H.
2" DRAIN FROM FAN
TRACK CUT
DUST CHAMBER FAN
STACK
KILN FEEDER BLDG


CABINET
LIMESTONE GYPSUM & CLINKER STORAGE BUILDING
TRAVELING CRANE
VIBRATING SCREEN
HOPPER
ELEV
CRUSHER BLDG
CRUSHER
RECOVERED WATER SUMP WATER PUMP
WET MILL
RAILROAD AND DRIVEWAY PLATEAU
SLURRY PUMPS
GASOLINE ENG. MOTOR GENERATOR SET
1½ HP AIR
8" CLAY OVERFLOW
TRANSFORMERS
6" SLURRY DISCHARGE
PUMP HOUSE
CLAY WASH MILL
CLAY AGITATORS
FIRE HYDRANT
SLURRY TANKS
SLURRY BASIN (MIXING)
SLURRY DISCHARGE PIPE
MAIN TRANSFORMER INCLOSURE
POLE
PROPOSED ROAD
DRAINAGE DITCH
6" CW SUPPLY
SLURRY BASIN (STORAGE)
OVERFLOW
2" CW
10" TC DRAIN PIPES
LOG ANCHOR
GUY CABLE
TAIL MAST
GASOLINE TRUCK RAILWAY
CLAY STORAGE YARD
HOIST HOUSE
RETAINING WALL
SCRAPER HOPPER
CLAY TANK
4" MR AIR
1½" CW
APPROX 500FT TO QUARRY
6" CW SUPPLY
APPROX 185'
WELL
WATER STORAGE TANK LOCATED 40' W S W

Power is obtained from the Utilization of Water Resources Power Plant, being delivered over the lines of the Porto Rico Light and Power Co., at a very favorable rate, and is a straight energy charge. No shut down or demand charge is included in the contract, which runs for five years and can be renewed for another five years.

Current is delivered to the substation at 22,000 volts, 3-phase, 60-cycle, and stepped down to 2300 volts for the crusher and grinding mill motors. The balance of the plant motors are 440-volt, 3-phase, 60-cycle, with the exception of the kiln motor which is 250-volt d. c., in order to obtain better control of the kiln speed, and the Poidometer motors controlling the rock and clinker feed to the raw and finish mills, respectively, which are also d. c.

Quarry

The limestone quarry is directly south of the plant. Drilling is performed by an Ingersoll-Rand wagon drill with 1¼-in. diameter drills and the secondary drilling is performed by Ingersoll-Rand Jackhamer drills, ¾-in. to ⅞-in. drill steel.

In order to provide more work for the Island's unemployed the quarry is a hand-loading proposition, and man-size stone is loaded into 2-cu. yd. capacity Easton Car and Construction Co. steel-body cars, and hauled to the crusher by a 6-ton Brookville Diesel locomotive.

The cars are dumped on a pan conveyor and thence into a Thor Pennsylvania hammermill, 48-in. circle hopper opening 3 ft. 6 in. x 5 ft. ½ in. for man size stone with a capacity of 75 net tons per hour, and guaranteed to crush 90 percent down to ¼-in. and under. The output is run over a vibrating screen and the oversize is returned to the crusher. The crusher house is equipped with a Sly dust collector to improve working conditions in and around the crusher. The crusher is driven by a 350-hp. Electric Machinery Manufacturing Co. synchronous motor, 2300-volt, 3-phase, 60-cycle.

Materials Handling

An 8-in. x 16-in. bucket elevator delivers the crushed products to the limestone storage building. This structure is 80 ft. wide by 280 ft. in length, and the material in it is handled by a 10-ton P. & H. traveling crane with a 2½-cu. yd. capacity bucket.

Bays in the storage building are 40 ft. span, and a gypsum storage bin of concrete walls 80 ft. x 60 ft. x 38 ft. in height is used to store one year's supply of gypsum for the plant, as freight on gypsum in 2500-ton lots is considerably cheaper than when delivered in small amounts, as would be the case in the United States.

The limestone and clinker storage are each 120 ft. in length. The storage building is roofed over and covered with Robertson asbestos protected, metal corrugated roofing and is constructed with siding for a distance of 10 ft. below the eaves.

The clay is excavated from a clay pit near the junction of the plant side track and the main line of the American Railroad of Puerto Rico. The clay is excavated by a Sauerman drag scraper having a capacity of 75 tons per hour. It is hauled by trucks to the clay storage south of the crusher building, which will hold 1200 tons of clay.

The clay is handled in the plant by a Sauerman drag scraper bucket, 50 tons per hour capacity, into the 26-ft. hexagonal wash mill, which is 10 ft. in depth. The washed clay flows into a 20-ft. diameter by 10-ft. deep clay storage tank. From this tank the clay slurry is pumped by a Wilfley pump into the raw mill feed. It is expected that about 100 lb. of clay will be required to every 500 lb. of limestone; but this may vary with final results on a commercial scale.

The limestone is fed by a Schaeffer Poidometer into the raw mill. Concrete bins of 16 hours' capacity have been constructed for limestone, shale, or iron or sand, and for feed for the finish mill of clinker and the necessary gypsum. (Clinker and gypsum are fed to the finish mill by a Schaeffer Poidometer as previously mentioned.)

Slurry Blending

The raw mill slurry is pumped by a Wilfley slurry pump to either of three concrete slurry tanks 20 ft. in diameter by 20 ft. high with a 20-ft. high basement underneath. The tanks are provided with F. L. Smidth mechanical and air agitators using 40 p.s.i. compressed air. These tanks hold a total of 1800 bbl. of raw slurry mix.

The slurry is fed by gravity to a mixing basin with semi-circular ends 20 ft. wide by 52 ft. in length, of 1800 bbl. of raw capacity, provided with an F. L. Smidth triple, mechanical and air agitator, each separate agitator unit being a duplicate of those in the 20-ft. diameter tanks. After the slurry has been properly mixed in this mixing basin to obtain the correct proportions, it is pumped by one of two duplicate 4-in. Wilfley slurry pumps to the kiln feed basin of the same size and equipment as the mixing basin. From here it is pumped to the kiln feed by one of a duplicate set of Wilfley slurry pumps.

The kiln feeder is the F. L. Smidth patented type. The waste gases from the kiln go through an F. L. Smidth dust chamber to remove the coarse dust, and from there through an F. L. Smidth induced draft fan No. 27, and up the stack. The stack is an Alphons Custodis reinforced-concrete stack, 7 ft. in diameter by 152 ft. in height, bricklined. No dust collector has been provided for the stack as the prevailing winds are away from the plant and from the nearby towns and houses.

The kiln has the F.L.S. patented chain system for 60 ft. of its length and is also provided with insulating brick for 135 ft. to conserve the heat. In addition, considerable saving of heat is made by the Unax cooler, which uses the hot clinker to preheat the incoming combustion air by means of its multiple cylinders and chain system. It reduces the temperature of the clinker leaving the kiln to about 350 deg. F. The necessary oil burner, low pressure fan, oil heaters, boiler, pumps, etc., are also included together with the F. L. Smidth kiln control system for temperature of waste gases, gas analysis, kiln speed and burning zone temperature exit gas analysis, etc.

Hot clinker is conveyed by an 8-in. x 16-in. bucket elevator from which it is delivered to the clinker storage.

Accessory Structures

There is a combined shop and storeroom building. The shop is equipped with two lathes, drill press, shaper, bench tools, electric welding machine, acetylene welder and the usual other small tools. The storeroom is provided with shelving to handle spare parts, tools, and mill supplies, etc.

The oil house is of concrete and used to store special oils, grease, etc. required for plant operation.

A dynamite storage with a capacity of 10,000 lb. of dynamite is constructed in a gulley in the hills southwest of the plant, accessible by a road.

Four 30-ft. diameter by 60-ft. high, and one interstice cement storage bins have been constructed with a total capacity of 43,000 bbl. These bins have a 12-ft. high basement underneath them. The cement is pumped into the bins through a Fuller-Kinyon conveying pipe line, and cement is drawn off by means of a system of 16-in. diameter screw conveyors and delivered to 8-in. x 16-in. bucket elevators and thence to the packing-house bins.

Two 3-tube, Bates bag packers are installed, and a reversible belt conveyor handles the bags into cars south of the pack-house at the railroad spur track, or into trucks at the road on the north side of the pack-house. A considerable amount of the cement will be transported by trucks directly to construction jobs.

All the elevators in the plant are 8-in.

(Continued on page 51)

Design Plant to Process Surplus Stone Screenings Into

DUST and STONE SAND

By RALPH S. TORGERSON

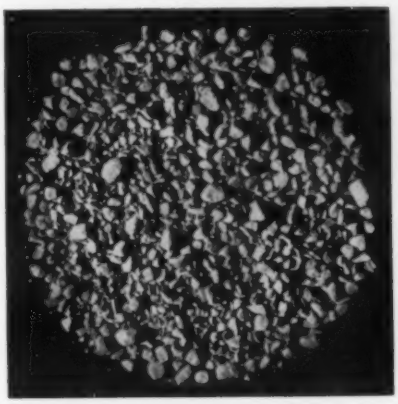
IN THE BOOM YEARS of the quarry business, large quantities of stone screenings were accumulated in stockpiles for which there was little demand. The Dolese and Shepard Co., La Grange, Ill., plant, like others, had a large quantity of this material and decided to find a market for it by processing into products having a commercial outlet.

To carry out this idea, a plant was constructed which was primarily designed for the production of stone sand with limestone dust as a by-product. Increasing demand for limestone dust, however, has led to the point where this plant, which started operation early in 1936, is now producing about one-third limestone dust and the balance stone sand.

Dry Screenings to Reduce Moisture

Raw material comprises two sizes, minus No. 3 mesh screenings and stone chips, ¼-in. to ⅝-in. At present this material is being reclaimed from stockpiles, located near the new dust plant, by a Bucyrus-Erie steam crane operating a 2¼-cu. yd. clamshell bucket, which dumps into a hopper outside the plant. This hopper feeds to a Link-Belt conveyor, 50-ft. centers, with a capacity of 30 tons per hour, which runs to a chute into the 6- x 60-ft. Kennedy-Van Saun rotary drier operating at 4½ r.p.m.

Raw material fed to the drier averages about 5½ percent moisture content which is driven off as it passes through under a temperature of 270 deg. F. The drier, which is fired through a Dutch oven with 4-in. lump coal, consumes 1¾ tons in 8 hours of firing. It takes one hour before starting operation in the morning to bring the drier up to the required temperature of 270 deg. F.



Actual size of stone sand product. Note cubical shape

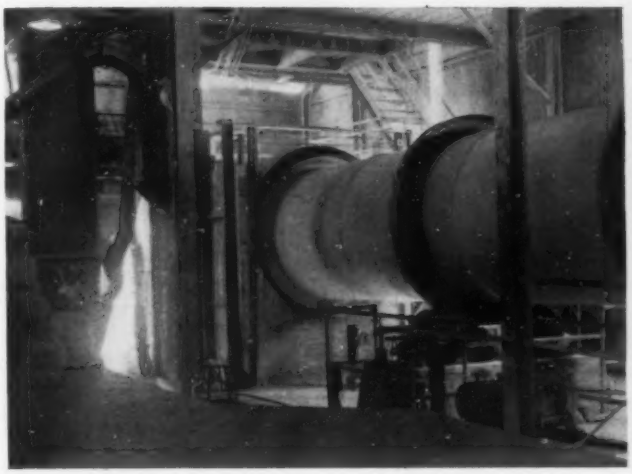
The workmen are employed on a 7-hr. shift and work through from 8 a. m. to 3 p.m. as it would not be economical to shut down the drier for a lunch period. It is essential that the temperature of the drier be maintained at 270 deg. as any reduction in temperature results in a caking of the material, caused by the presence of moisture.

Produce Cubical Stone Sand

Heated screenings from the drier drop into a boot of the vertical, enclosed, No. 1 Link-Belt bucket elevator, 42-ft. centers, with a capacity of 30 tons per hour, and is elevated to a 4- x 10-ft. Lippmann double-deck, vibrating screen, the upper deck of which is No. 4 mesh and the lower No. 8 mesh. The feed and discharge connections are new type, flexible dust-proof, heat-proof connections devised at the plant. Oversize retained on No. 4 mesh and No. 8 mesh screens goes to a surge bin feeding a Gruendler ring hammer crusher. All minus No. 8 mesh material passes through a spout to the No. 2 enclosed Link-Belt bucket elevator, 58-ft. centers. The oversize going to the crusher is passed through a series of bars with 1/16-in. openings. Arrangement of these bars was the result of much experimentation to obtain a cubical stone sand product without reducing the capacity of the crusher.

Screen analyses of the stone sand show that the product is kept within the tolerances of both the federal and state of Illinois specifications. The Illinois specifications are as follows: No.

Left: Interior view of dust plant, looking toward Dutch oven of rotary drier, No. 1 and No. 2 elevators, and in the background to the left may be seen pipes leading into dust collector on the second level platform. Right: Feed end of rotary drier. Above drier is shown conveyor which carries screening to hopper feeding the rotary drier

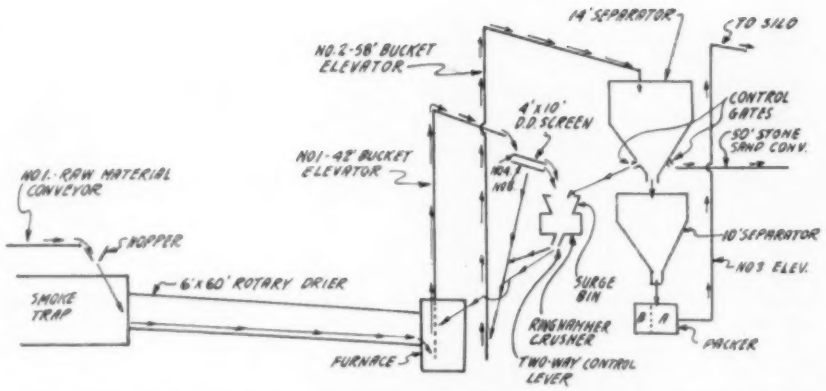


⅜, 100 percent; No. 4, 95 to 100 percent; No. 8, 70 to 90 percent; No. 16, 45 to 75 percent; No. 50, 5 to 20 percent; and No. 100, 0 to 5 percent. Federal specifications are as follows: No. 4, 95 to 100 percent; No. 16, 45 to 80 percent; No. 50, 5 to 30 percent; and No. 100, 0 to 10 percent.

Below the crusher, the spout branches off, one leg going to No. 2 elevator and the other to No. 1. A lever operates a gate which permits throughs from the crusher to flow in any proportion desired to either elevator, giving the plant considerable flexibility in operation. This arrangement makes possible a non-circulating system for the production of maximum quantities of stone sand, and a circulating system with the object of producing larger quantities of limestone dust.

Minus No. 8 mesh material from the double-deck screen and the throughs from the crusher are chuted to the No. 2 elevator and then to a spout leading to a 14-ft. Raymond separator which removes practically all the dust, the tailings being stone sand 97.95 percent passing No. 8 mesh. Stone sand is carried outside the dust building on a belt conveyor, 50-ft. centers, to a 50-ton Butler bin. When the bin is filled, the excess is chuted to a stock pile.

Should it be desired to make a larger proportion of limestone dust, a gate shuts off a portion of the flow of stone sand and by-passes it to a drag leading to the surge bin feeding the crusher.



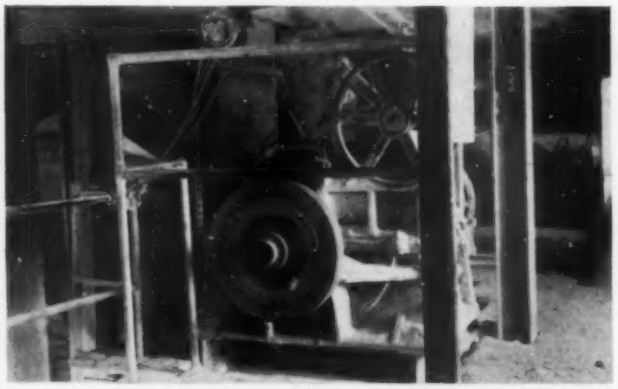
Flow sheet of limestone dust and stone sand plant which is processing large quantities of accumulated screenings

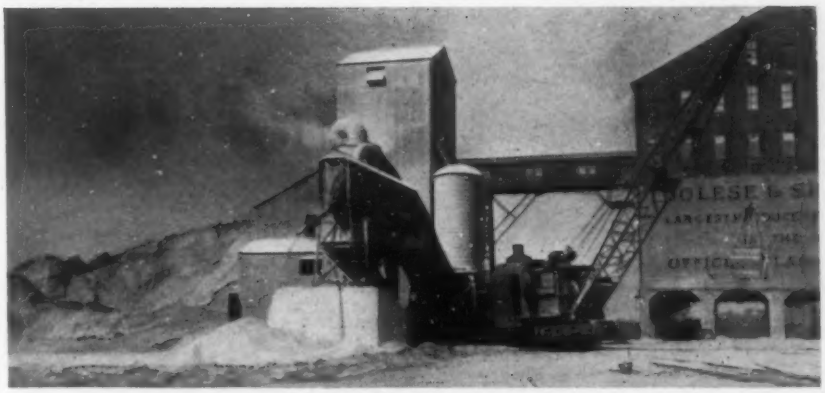
Two Dust Products

Directly below the 14-ft. separator and closed-circuited with it is a 10-ft. double-cone, Raymond separator which receives all the dust, minus the stone sand removed in the 14-ft. separator. The 10-ft. separator produces two dust products, A and B, which are passed into two compartments feeding the Bates 3-bag packing machine. A Bindicator, mounted in the surge bin feeding the packer, serves to maintain the dust at a level so that air is excluded from the packing valves. Dust A is 92.9 percent passing 200 mesh and B is 75.1 percent passing 100 mesh. The limestone dust is produced in the proportions of 3½ to 4 of A to one of B. About 35 tons of dust and 77 tons of stone sand are produced in a 7-hr. run or about 5 tons of dust per hour. About 31 percent of the products recovered from 112 tons of raw material handled in a 7-hr. day comprises limestone dust.

In loading out limestone dust for carload or truck bulk shipments, two

Above, left: Double-deck vibrating screen. Right: Ring hammer crusher which reduces screenings to dust and cubical stone sand. Below, left: No. 3 elevator in the background and lower end of 10-ft. separator. Right: Three-valve bag packer





To the left, modern limestone dust plant, showing stockpile of screenings, 50-ton bin for storing stone sand in foreground, concrete storage silo for dust shipped in bulk. Stone screening and crushing plant to the extreme right

valves are opened on the bagging machine and the dust is by-passed to No. 3 elevator and a spout leading to an outside 60-ton storage silo adjacent to a railroad track. A large diameter hose connected to the silo is attached to a screw conveyor type carloader which was devised and built in the repair shop of the plant. The silo itself is of interest as it is made of concrete silo staves reinforced with steel hoops.

Dust Collector Improves Plant Conditions

To eliminate dust in the atmosphere within the building as much as possible, the plant has recently been equipped with a No. 30 Clark, skimmer type, dust collector. The fan for the dust collector is a 25-hp. Jeffrey No. 1665, which was formerly used in a coal mine. All points where dust may escape into the atmosphere have been equipped with dust collecting pipes leading to the dust collector. The combination of an efficient drier and the dust collector has eliminated all moisture condensation which is often a problem in dust plants.

The plant has a capacity of from 15 to 17 tons per hour of raw material and a 10-ton circulating load, a total capacity of approximately 25 tons. While raw material from the stockpiles is now running about 5½ percent moisture, it may be possible to step up production in the future when dry stone is taken directly from the quarry and screenings are obtained with a low moisture content.

The average operating power load is 130 kw. All equipment is operated by individual electric motors driving the following equipment: No. 1 conveyor 2-hp., drier 40-hp., No. 1 elevator 5-hp., No. 2 elevator 7½-hp., screen 5-hp., 14-ft. separator 30-hp., 10-ft. separator 15-hp., No. 2 stone sand conveyor 2-hp., drag 1-hp., bagging machine 25-hp., No. 3 elevator 2-hp., crusher 75-hp., screw conveyor carloader 2-hp., dust collector fan 25-hp.

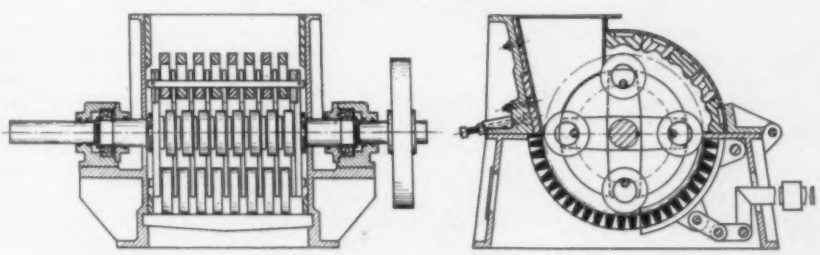
Two kinds of stone sand, both minus No. 8 mesh, are produced; a very clean, coarse product and a product with more fines. The coarse product is made with chips, ¼-in. to ⅝-in., raw material, while the product with a greater percentage of fines is produced when screenings of minus No. 3 mesh are used. The coarse stone sand is in demand for use in manufacturing concrete burial vaults. The finer stone sand makes a very excellent aggregate for a finishing concrete. It is also sold for agricultural limestone.

Many uses have been found for limestone dust. It is used as an ingredient in fertilizers and livestock feeds, as a dusting material for coal mines, dairy floors and packing house plants, as an asphalt filler, and farmers mix the dust with the grain in seeders. There are other commercial uses too numerous to mention.

Improvements being considered for the future include a tunnel conveyor system to reclaim raw material from stockpiles to the plant in place of the present crane and clam shell bucket arrangement. If it is desired in the future to increase the production of dust up to 100 percent capacity, a ball mill will be placed in the circuit.

Officers of the company include: William Roy Carney, president; William J. Schwass, superintendent, and George B. Massey, consulting engineer.

Construction details of ring hammer crusher used in making cubical stone sand. Crusher operates at 720 r. p. m.

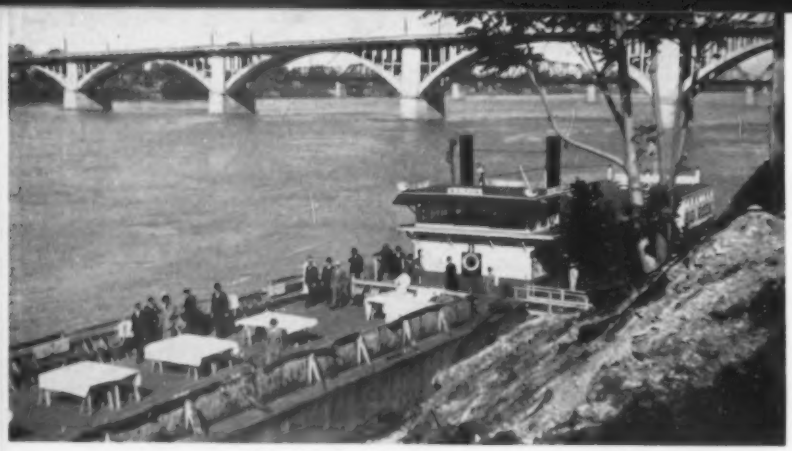


Indiana Producers in One Association

INDIANA is probably the only state in the Union which continues to have an active association combining both crushed stone and sand and gravel producers in its membership—and from all indications the association is functioning very successfully.

President Charles H. Purdum of the Indiana Mineral Aggregates Association in his annual convention address this spring very clearly pointed out why the association has worked out its problems to the satisfaction of all branches of the aggregates industry. He said, "While the Association has had its difficulties, and doubtless will continue to have some internal problems requiring patient and tactful handling by all concerned, it undoubtedly is the general feeling of the members that such difficulties are much better handled in a combined association than through separate associations which would probably only magnify such sources of friction. It has been stated many times, but deserves repetition, that for every interest the branches of the aggregates industry have in conflict they have at least a dozen interests in common."

Undoubtedly, the organization set up of the Association also has had an important influence in its success. The Association is governed by an Executive Committee consisting of 14 members: the president, two vice-presidents, the secretary-treasurer, and ten directors. The two vice-presidents represent the branches of the industry not represented by the president. There are five districts in the state each of which is represented by two directors, one a sand and gravel producer and the other a crushed stone producer. Officers and directors constitute an executive committee through which the work of the association is handled with the help of special committees appointed from time to time. The executive committee meets frequently throughout the year and every live problem of the industry is under constant observation and study.



By BROR NORDBERG

Stage Excursion For Engineers At Opening of New STONE WASHING PLANT

"SHOW BOAT DAYS" of early Mississippi River history were revived on April 21, when the Big Rock Stone and Material Co., Little Rock, Ark., held a formal opening of a new stone washing and screening plant with an excursion trip up the river to the site of the plant attended by 50 prominent engineers, architects, builders and contractors as guests of President R. Snow Wilson.

No yacht was available for the excursion, but the company's big sand barge and the stern-wheel steamer "Big Rock," served the purpose very nicely. Entertainment was furnished by the "Show Boat Revue", and refreshments were served by hotel employes hired for the occasion.

The first stop, after the boat left the landing at the company's main plant at Little Rock, was alongside "Big Sandy," a sand dredge belonging to the company, to see a demonstration of its operation. From this point, the party was taken on up the river to the company's new stone washing plant on the north bank of the Arkansas River where the guests had an opportunity to inspect the new plant and watch the various operations. After inspecting the plant, the guests were taken on a short trip farther up the river, during the course of which they were entertained by the "Show Boat Revue" and were treated to refreshments.

Simple But Efficient Plant

The most impressive thing about the plant, which replaces a dry screening operation, is its simplicity for a 200-ton per hour plant, and the refinements that contribute greatly to its operating efficiency. In the quarry, which is a mountain of blue trap rock near the Arkansas River, there are several interesting features. First of all, the height of the face is 200 ft., which in itself is unusual. Secondly, the face is drilled to its full depth by well drills and is shot without benching, which has been found more economical than tunnel drilling and shooting. Delivery of the stone to the gyratory primary crusher is by trucks over a cold mix asphalt road that surpasses many of the county and state roads anywhere.

This roadway is maintained regularly and is wide enough for two-way traffic. At the crushing plant, a concrete slab runway has been built, over which the trucks are maneuvered in dumping stone into the crusher. The practice of maintaining smooth surface roads for the heavy quarry trucks has paid dividends in less tire replacement and truck maintenance.

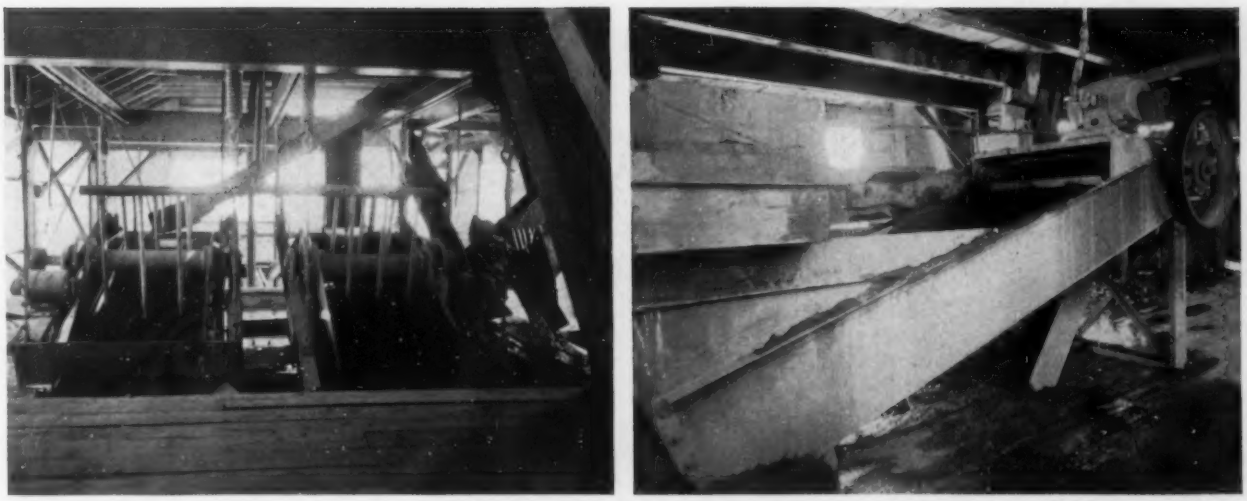
The plant layout is simple, but compact, and is almost self-explanatory from the accompanying flow sheet. Trucks (3) are loaded by a Bucyrus-Erie 3-cu. yd. electric shovel and haul from 12 to 15-ton loads to the primary crusher.

Crusher discharge is to a 43-in. belt bucket elevator, 72-ft. centers, to a 4- x 12-ft. Allis-Chalmers suspended style B scalping screen. The tail pulley of the elevator is a Sprout-Waldron self-cleaning, wing pulley, and the idler bearings are SKF $1^{15}/_{16}$ in., self-aligning, water- and dust-proof bearings, as are also the bearings in the other Allis-Chalmers belt-bucket elevator.

Plus 2½-in. stone (square openings) is split to two 10-in. Newhouse crushers; the ½- to 2½-in. stone by-passes the crushers to the screening plant; and the ½-in. minus stone goes to a 14-in. twin screw sand washer. Throughs from the 10-in. crushers and the ½- to 2½-in. product from the scalping screen are raised for further scalping by a 37-in. belt bucket elevator, 78-ft. centers, and split over two 4- x 10-ft. single-deck, vibrating screens with 2½-in. square openings. Minus 2½-in. material from this screen is passed by chute to the finishing screens on the floor below.

Inspection party alongside "Big Sandy" dredge, watching sand recovery machinery in action

Plus 2½-in. stone from the 4- x 10-ft. screens is carried over a 36-in. belt conveyor and split to two No. 7 Newhouse crushers, and then is circulated back over the same screens by the 78-ft. elevator. When all stone is reduced to 2½-in. and under, sizing and washing is done over the finishing screens. There are four 4- x 8-ft. double-deck, finishing screens set in pairs in tandem. Screen openings, of course, are available for producing various products, but gener-



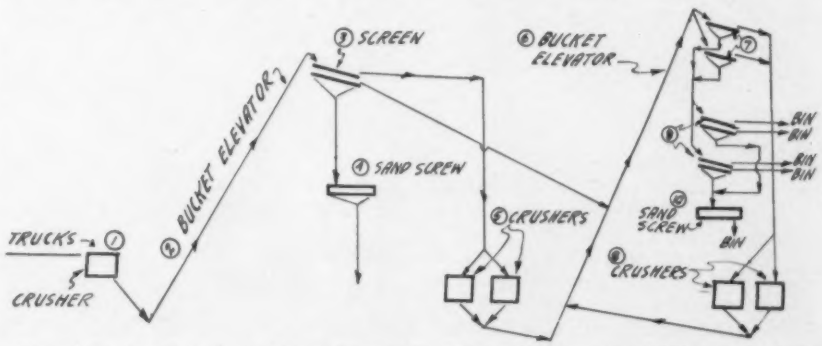
Left: Two of the vibrating sizing screens where stone is given an extensive scrubbing. Right: One of the two twin screw washers for scrubbing chip sizes coming through the sizing screen

ally ½-in. square openings are maintained on the lower decks.

Recovery of Fines

All stone sizings go direct to bins and the ½-in. minus product to another 14-in. twin screw sand washer. One of the interesting features of the plant is the handling of the chat (minus ½-in.) through two screw washers. Stone passing through the 4- x 12-ft. scalping screen has been broken only once so the coarser grades of fine product are recovered in the screw washer below and scrubbed.

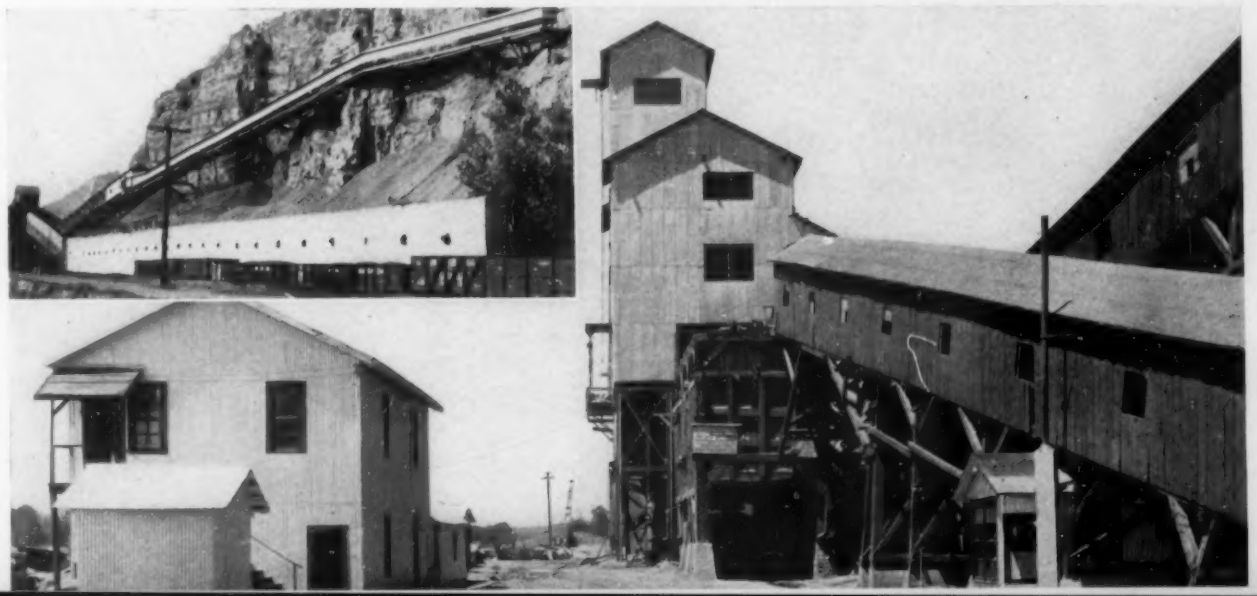
A higher percentage of fines is handled through the screw washer below the finishing screens, since fines are a product of a number of passages through crushers. The washers were installed as a re-washer for removal of dust and mud, and classification of the fines is controlled by the washer tail gates. Overflow and discharge levels of the box can be raised or lowered to regulate the fines to be recovered. A typical specification for fines produced (asphalt topping) requires that all material pass the ½-in. sieve, 20 percent through the ¼-in. and 3 percent to be finer than 100 mesh. To wash out excess fines, water, in addition to that coming from the finishing screens, is added at the feed end through perforated pipe on the screw blades in one washer. The product of both washers can also be blended very easily.



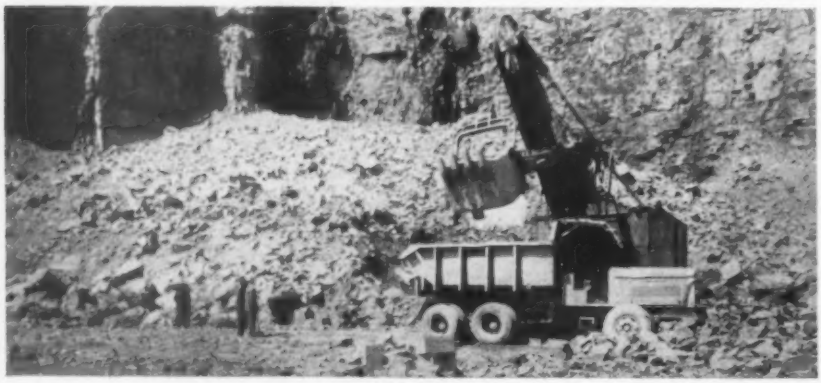
Flow sheet of new stone washing and screening plant with a capacity of 200 tons per hour

Bin storage of 300 tons in four bins is supplemented by an open stockpile of about 75,000 tons capacity. Stone from the bins is released through side bin

View from East side of plant showing covered belt conveyor to stockpile and return belt conveyor from tunnel. Insert shows storage bin along face of rock wall, stockpile conveyor, and conveyor from the end of tunnel which runs full length of storage bin



West side of plant with truck dumping into primary crusher. Concrete slab runway has been built up to the point where trucks dump into crusher



Working a recent "shot" where over 59,000 tons of blue trap rock was brought down, using safety explosives

Electrical control room in stone plant in which plant electrician is stationed. All operating machinery may be seen and controlled from this room

gates to belt conveyors for stockpiling, and stone from the stockpile is reclaimed over a tunnel belt conveyor for passage through the plant before shipment. Two 30-in. belt conveyors, one on 250-ft. centers and the other on 400-ft. centers, place stone into stockpile, and two more conveyors, a 425-ft. followed by another on 225-ft. centers, reclaim stone for shipment. Shipments are made by rail on the Missouri Pacific and by trucks.

Wash water is supplied from a pump house on the river bank set 35-ft. below the ground level. The pump is a 10- x 12-in. Allis-Chalmers pump, capable of pumping 3500 g.p.m. at a 180-ft. head. Two suction pipes are provided at different levels to allow for variations in the water level of the river. In the pump house are provided two gasoline-driven pumps with a combined rating of 2000 g.p.m. for standby service. Wash water is introduced over the plant screens through Binks and Rex nozzles.

The pumping plant was built three years ago in anticipation of the construction of the new washing plant, and is designed to supply wash water continuously despite variations of as much as 21 ft. in the stage of the Arkansas River.

In the very center of the screening plant is the control house, which is enclosed with windows so that the chief electrician can observe all machinery in operation. This control station is complete with ammeters, voltmeters, push button and manual starters.

Special care in designing and building this plant has been given to safety devices and the elimination of hazards for employes. The outstanding feature is the complete elimination of all dust. Water is applied on the stone at the primary breaker and on all screens throughout the plant, which does eliminate all dust, and not only very materially improves the product but makes working conditions pleasant and agreeable.

Below are itemized the drives (Texrope) on the major plant equipment:

Electric motors	Equipment
200 hp.	No. 9K McCully crusher
60 hp.	No. 2 elevator (Allis-Chalmers)
50 hp.	No. 1 elevator
7½ hp.	4-x12-ft. Allis-Chalmers screen
150 hp. (2)	No. 10 Newhouse crushers (2)
100 hp. (2)	No. 7 Newhouse crushers (2)
5 hp. (2)	4-x10-ft. Allis-Chalmers screen (2)
5 hp. (4)	4-x8-ft. Allis-Chalmers screens (4)
10 hp. (2)	Telsmith twin sand screws (2)
300 hp.	10-in. Allis-Chalmers pump

In addition to ballast and commercial stone, considerable tonnage of rip-rap one-man size stone is shipped. This stone is sledged and stockpiled in the quarry by a 1¼-cu. yd. Lambert automatic skip bucket which is hauled by a Chevrolet truck.

Large Sand Plant Increases Capacity Without a Shut-Down

CHANGE DRY to WET EXCAVATION

By A. B. AMOS, JR.*

IN THE MARYLAND COASTAL PLAIN sand and gravel region, north of Baltimore, a new plant, presenting several interesting features, has recently been placed in operation. Located at Whitemarsh, Md., adjacent to the new Maryland dual highway from Baltimore to Aberdeen, this plant represents the addition of large scale sand and gravel producing facilities to the existing extensive stone quarry and contracting operations of Harry T. Campbell Sons Co., of Towson, Md.

Originally operated a number of years ago by the Whitemarsh Sand & Gravel Co., using a small, plain, suction dredge, the deposit varies from a marsh area with practically all of the aggregate material located below water level, to rolling ground where 10 to 15 ft. of sand and gravel exists above water. Many of the above-water strata are in various degrees of cemented structure.

The need for aggregate material for a section of the dual highway on Maryland Route 40, under contract by the owners, actuated the initial plant development in July of 1936. However, additional road aggregate requirements, plus substantial orders from other material users, including a 300,000-ton order from James Stewart Co., of New York City, to be used in constructing a new strip mill for Bethlehem Steel Co. at Sparrows Point, Md., about 16 miles distant, led to expansion and improvement of facilities early in 1937.

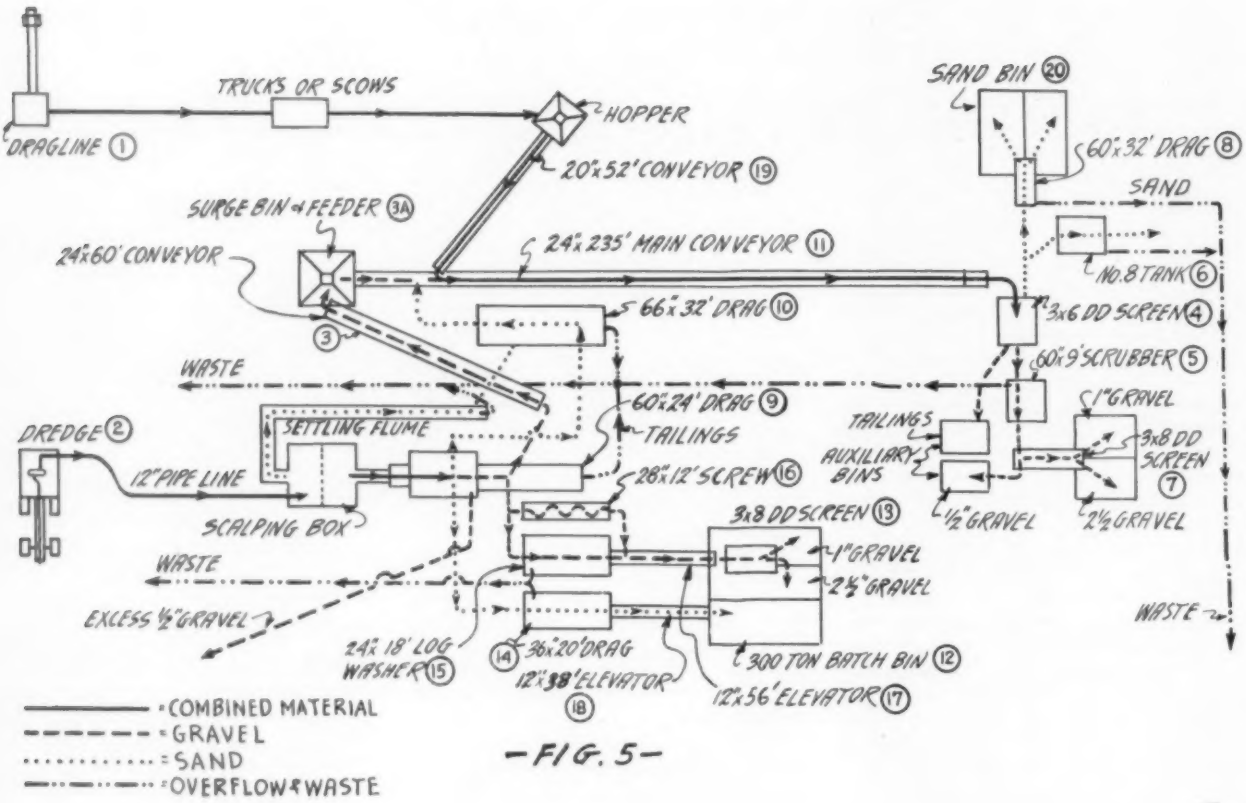
Selection of the original plant location was due to the following factors: it had a satisfactory elevation for drainage purposes, it offered a substantial flat area for minimum of grading, good space for large stockpiles; and at the same time, it was adjacent to the new highway. A location directly on the B. & O. R. R. tracks was not chosen due to limited space between railroad and the highway, and the additional difficulties of trucking or conveying all the raw material across or under the new highway. Material shipped in cars is readily handled by auto trucks from the plant to a car loading ramp erected adjacent to the railroad siding.

A Koehring No. 601 crawler crane, with a 1 cu. yd. clamshell bucket, was originally employed for stripping off topsoil and excavation of the raw material. The material was delivered to a 20-ton portable, steel hopper bin equipped on top with a bar grizzly to reject boulders, and with a 20-in. x 5-ft. reciprocating plate feeder underneath. This feeder furnished a regulated discharge from the bin to a portable field conveyor, which in turn discharged material on to the main plant conveyor. The latter was designed with a 60-ft. horizontal extension, as shown in Fig. 3, which permitted operation of the field conveyor over a substantial rectangular area on each side as well as in the circular area, radiating from the end of the main conveyor. Fig. 3 also shows clearly the horizontal pulley and cable type belt tightener employed. As the excavating operation progressed, the crane moved the loading bin and field conveyor to each new location, manipulating the equipment so that the maximum pond area was dug and would still leave enough space for a runway next to the conveyor on which the crane could operate.

To secure speed and economy in construction, the design of the main washing and screening plant was based on the use of existing contractor type steel bins located inside of an independent

* District Manager, Smith Engineering Works.

Fig. 1. General view of plant from the north. Note batch bin for road jobs at the left, with crane in operation over center compartment, main plant in center, with gravel loading tunnel and sand storage bin at right. Flume at the left is waste water, flume at the right is for excess sand



—FIG. 5—

TABULAR ANALYSIS OF EQUIPMENT OF THE GWYNNS FALLS STONE CORP. SAND & GRAVEL PLANT, WHITE MARSH, MD.

Operation	Equipment	Make	Model No. or Size	Power Source	Transmission
Excavating	① Dragline (1¼ yd. bucket)	Bucyrus-Erie	No. 33-B (80' x 26')	Caterpiller D-13,000	
	② Dredge	Hetherington & Berner	12-in. pontoon hull		
	② Dredge pump	Hetherington & Berner	12-in. manganese	300 hp. var. speed Allis-Chalmers	Direct-connected
	② Cutter	Eagle Iron Works	Swintek—30-ft.	20 hp. 900 rpm Allis-Chalmers	V-belt
	② Hoist	Amer. Hoist & D. Co.	5-drum	20 hp. 900 rpm Allis-Chalmers	V-1
	② Service pump	Manistee	7½—3V 200 GPM/198'	15 hp., 3500 rpm G. E.	Direct-connected
Scalping and de-watering plant	⑥ Rotary scalper	Traylor	60-in. x 24-ft.	25 hp., 685 rpm West.	V-belt
	⑫ Sand drag	Telsmith	66-in. x 60-ft.	7½ hp. Master gearhead	Roller chain
	⑦ Gravel conveyor	Barber-Greene	24-in. x 60-ft. lattice frame	U. S.—3 hp., 1750 rpm	V-belt
	(3a) Feeder	Telsmith	20-in x 5-ft. with friction clutch	U. S.—3 hp., 1750 rpm	V-belt
Auxiliary plant	⑫ Bin	Blaw-Knox	300 ton—comp.—(batch)	2-yd. weigh batcher	
	⑬ Sizing screen	Telsmith	3 x 8 D. D. pulsator	5 hp. fully encl. Master, 1750 rpm (b)	V-belt
	⑭ Sand drag	Telsmith	36-in. x 20-ft.	7½ hp. Master gearhead M.	Roller chain
	⑮ Log washer	Telsmith	24-in. x 13-ft.	30 hp., 1200 rpm G. E.	V-belt
	⑯ Screw washer	Telsmith	28-in. x 12-ft.	10 hp., 900 rpm	Chain
	⑰ Gravel elevator	Telsmith	12-in. x 56-ft. centers	7½ hp. Master, 1200 (b)	V-belt
	⑱ Sand elevator	Link-Belt	12-in. x 38-ft. centers	10 hp. G. E., 1750	V-belt
Auxiliary feed conveyor	⑲ Belt conveyor	Robins	52-ft. centers—20-in. wide	3 hp. G. E. 1750	V-belt
Main conveyor	⑪ Belt conveyor	Telsmith	24-in. x 235-ft. centers 3 pulley idlers	100 hp., 870 rpm (a) thru countershaft	Belt from countershaft
Main plant	① Scalping screen	Telsmith	3- x 6-ft. D. D. pulsator	5 hp., 1750 rpm Master (b)	V-belt
	⑤ Scrubber	Telsmith	60-in. x 9-ft. Sup. ball mill with rev. cur.	100 hp., 870 rpm (a) to countershaft	V-belt
	⑦ Sizing screen	Niagara	3- x 8-ft. double deck	5 hp., 1750 rpm Master (b)	V-belt
	⑥ Sand tank	Telsmith	No. 8		
	⑧ Sand drag	Telsmith	60-in. x 32-ft.	7½ hp. Master gearhead	Roller chain
Water supply	Main pump	Yeomans	5-in horizontal, Timken bearing, 1000 gpm/105' TDH, 1750 rpm	75 hp., 870 rpm thru countershaft	V-belt
	Auxiliary pump	Fairbanks-Morse	4-in., 1750 r.p.m.		V-belt

(a)=100 hp., 870 r.p.m. motor drives both main conveyor and scrubber through a countershaft.
(b)=fully enclosed, fan cooled motors.

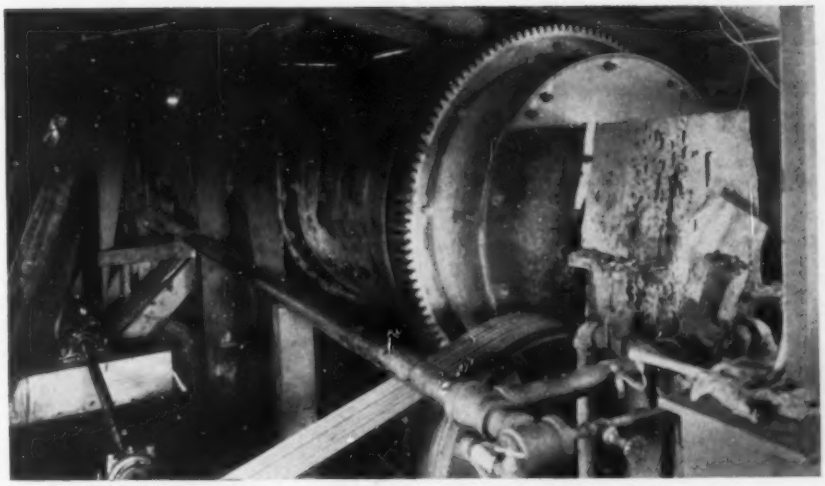


Fig. 2. Ball mill type, high speed scrubber with removable steel liners to remove clay

bolted steel framework specially designed to carry the main plant equipment above the bins, and with a chute system capable of delivering all sizes of material either to bin compartments, or to adjacent stock piles, a view of which, together with reclaiming crane, is shown in Fig. 1. This unusual arrangement is of interest, when compared with the conventional practice of supporting the machinery on large capacity bins, as it reduces the total plant investment, permits quick and less expensive re-location wherever that factor is a possibility in the future, and also makes possible swift erection. On the other hand, more steel and careful design are necessary to insure rigidity against excessive vibration than where the columns are integral with a heavy bin structure.

Original plant layout as shown in Fig. 8 has been retained in the new plant setup. A unique feature is the use of a ball mill type, high speed scrubber with removable steel liners, to remove clay, which for this work has proved far superior to the ordinary combination rotary screen and scrubber. Incoming raw material was conveyed up the main conveyor at the rate of 80 to 90 tons per hour, and delivered to a steel lined mixing or agitating box, where cascading and soaking action was secured by a high pressure water nozzle; the flume from this box to the double-deck scalping screen was reversed in direction to secure still further preliminary breaking up and soaking. Rejects from the 2¼-in. square openings on the top deck of the scalper were chuted direct to a small steel bin set along side and wasted, as there were not enough of them to justify installing a crusher. Material passing the ¼-in. square openings on the bottom deck was flumed to an automatic tilting sand settling tank, producing concrete sand. Sand tank discharge was either direct to stockpile or to a screw rewasher located over an auxiliary bin. Material passing top deck and rejected by bottom deck entered the 60-in. ball mill scrubber shown in Fig. 2. This machine, operating at 30 rpm., with a perforated pulp discharge plate at feed end and reverse current of clean water against material flow, broke up clay balls, cemented clusters, etc., and delivered a clean gravel product to a 3- x 8-ft. double-deck sizing vibrator below, by an adjustable chute with which the capacity of the machine may be adjusted to varying conditions of incoming gravel, by regulating the distance which it projects into barrel. The vibrating sizer separated three sizes of gravel, which were delivered by a chute

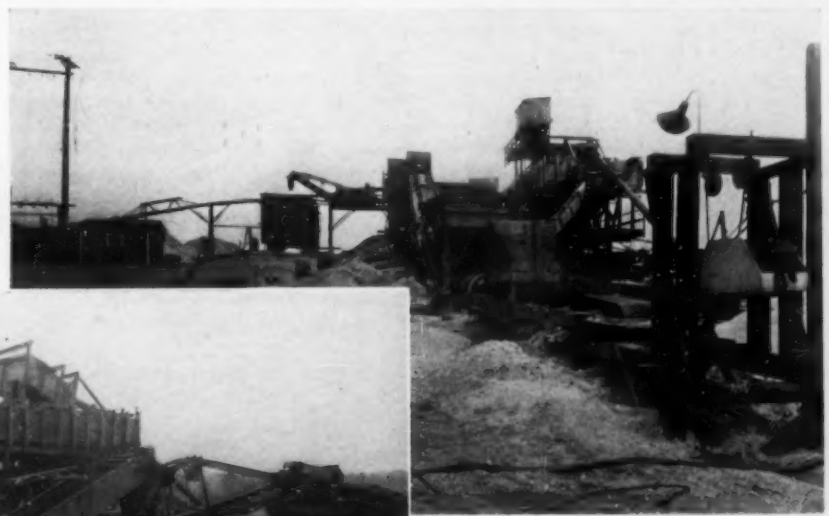


Fig. 4, below: Close-up of de-watering plant showing gravel surge bin on right, rotary screen at left, sand drag in center, and auxiliary conveyor for dry feed in foreground

Fig. 3, above: View of plant from the south. Note horizontal extension of main plant conveyor with novel belt tightener. Wash water pump house and power sub-station at left.

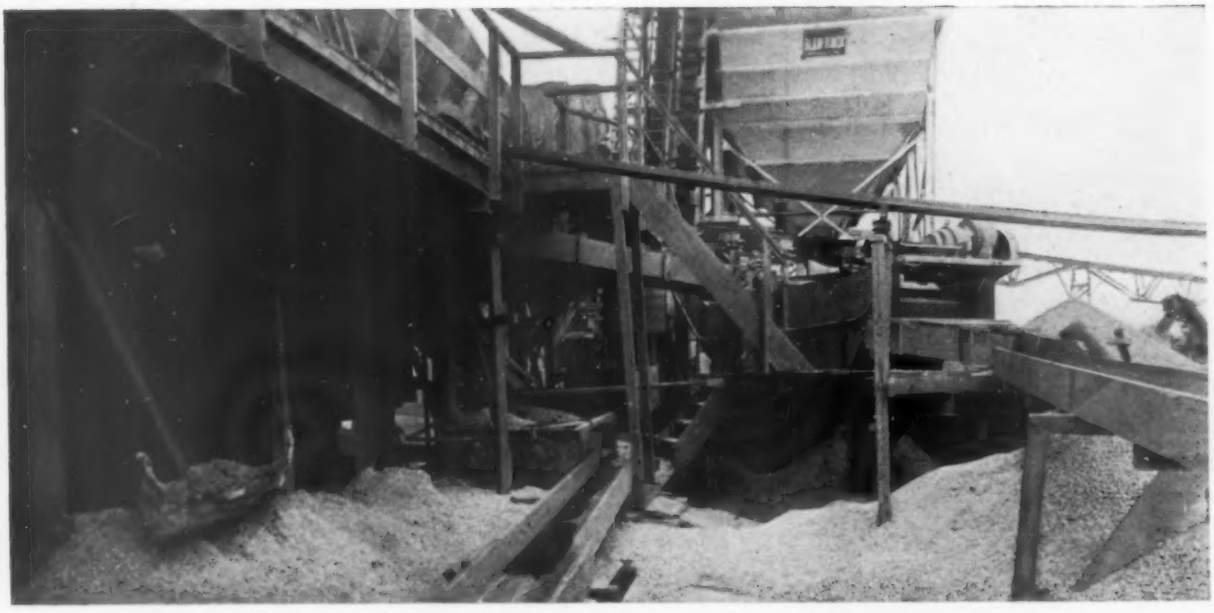


Fig. 6. To the left, below, log washer, and to the right, sand drag used to insure clean material feed to auxiliary plant

system to either bins or stockpiles below. Overflow from sand tank was flumed to a circular settling basin away from plant, as shown at extreme left of Fig. 1, where waste was allowed to settle out and clear water return to pond. Excess sand production was flumed to a storage pile as shown at right of Fig. 1.

Power for operating original plant consisted of two 75 hp. gasoline power units, one of which drove the main conveyor and scrubber through a countershaft, and the other the 1000 g.p.m. wash water pump and a 20 kw., d-c. generator, from which current was supplied to operate feeder, field conveyor, lights and vibrating screens.

Plant Expansion

Early in 1937, as mentioned previously, it was necessary to expand the excavating radius from the plant and at the same time insure a steadily increasing supply of raw material, much of which was located below water level. To satisfy these requirements, the steel pontoon hull, hydraulic dredge equipped with chain agitator ladder, originally installed at the Bristol Sand & Gravel Co. and previously described in the April 9, 1932 issue of ROCK PRODUCTS, was installed in the pond opened up by the initial crane operation. This dredge is electric powered, and the general layout is shown in Fig. 10. The pontoon hull is 80-ft. long by 26 ft. beam, and operation is by shore lines, two forward and two aft, which together with ladder hoist line, utilize the five drums of the hoist. Changes to the dredge included a new wood, deck-house, new service pump and new ladder chain. The chain agitator ladder possesses the operating advantage of conveying boulders, large roots, etc., away from nozzle and depositing them back in the previously excavated area under dredge.

Fig. 10. Hydraulic dredge equipped with a chain agitator ladder and mounted on steel pontoon hull

To permit feeding to existing main conveyor, a de-watering plant shown in Figs. 3 and 4 was incorporated in the layout. This consisted of a large area, wooden scalping and settling box designed to scalp out a maximum of clear water at one end and pass the balance of water and material at the other end, at a greatly reduced velocity, to a rotary scalping screen. A sand drag was located nearby, to dewater sand from the flow through the jacket and to deliver it to the main plant conveyor. Rejects from the scalping screen, consisting of boulders and clay lumps, were flumed back to the pond, using the sand drag overflow to secure sufficient conveying velocity. Gravel passing through the scalping screen was delivered by a 60-ft. conveyor to a surge bin located over the main plant conveyor and equipped with a mechanical feeder to provide a steady rate of feed. The surge bin, feeder and 60-ft. field conveyor were units reclaimed from the original crane loading plant and re-located in this new position. Circular holes in the long settling box were provided to permit accumulated fine sand from diverted or scalped portion of water to flow by troughs to main sand drag and thence to main conveyor. Under the rotary scalper, an adjustable hopper system was provided to permit distributing the dredge output between main plant and auxiliary plant in any desired ratio.

To absorb the variable excess capacity due to surges in dredge pump delivery beyond maximum capacity of main plant, an auxiliary plant was in-

stalled adjacent to de-watering plant, consisting of a 300-ton three-compartment batch bin equipped with a 2-cu. yd. weigh batcher, and with an independent bolted steel frame work carrying a double-deck vibrating sizing screen, a 12-in. bucket gravel elevator and a 12-in. bucket sand elevator. Sand feed to this auxiliary plant was classified in a 36-in x 20-ft. steel box sand drag taking an adjustable split flow from below scalper jacket, and gravel was scrubbed in a twin steel box log washer taking an adjustable split feed from below rotary scalper, layout being shown in Figs. 6 and 7. Originally located in the main plant, the steel box screw washer which has been re-located in parallel with the log washer to augment scrubbing capacity under favorable feed conditions. Additional spray water capacity for auxiliary plant units was provided by a centrifugal pump, installed adjacent to the main pump, and driven by a V-belt drive off a common countershaft.

To further insure delivery of raw material to the plant at maximum capacity at all times and under all conditions, a truck loading hopper and a feed conveyor to main belt were provided, as shown in Fig. 4. This unit permitted dry feed to plant from a Diesel crawler crane with a 1¼-cu. yd. drag-line bucket operating on the higher bank areas of the deposit. Delivery to the hopper was formerly handled by trucks, which were later superseded by scows, towed by a power boat to a wharf built near the water supply

Fig. 9. View showing 300-bbl. bulk cement bin and car unloading plant, and also part of a fleet of trucks with three-compartment batch bodies

pump house, and then unloaded by a crane with a 1-cu. yd. clamshell bucket.

Power

With the greatly increased demands for power, the necessity of maximum continuity of operation, and the existing electrified dredge, it was decided to change the plant over to central station supply from a 4000-volt, 3-phase, 60-cycle line. A sub-station was constructed (see Fig. 3) with primary transformers reducing the plant voltage to 220, and auxiliary transformers providing 2300-volt current to the dredge through a submarine cable carried on the pipe line pontoons. The 75-hp. gasoline engines were replaced by electric motors, but the original power unit countershafts and drives were retained, to minimize change-over time. Existing d-c. motors were replaced by a-c. units, with changed sheaves or pulleys where the speeds were higher than with the original d-c. units. New a-c. motors of proper size and speed were obtained for the additional equipment. Details as to sizes and speeds of all power units will be found in the tabulated analysis of equipment. A complete lighting system was provided for night operation. An interesting feature of this elaborate change-over was that all additions and changes were made without shutting down the original dry fed gasoline power driven plant, except nights and Sundays.

Stepping up plant output so materially made necessary substantial extensions to the live storage facilities of the

Fig. 7: Auxiliary plant with 300-ton, three compartment batch bin equipped with a 2 cu. yd. weigh batcher, and with an independent steel framework carrying a double-deck vibrating sizing screen

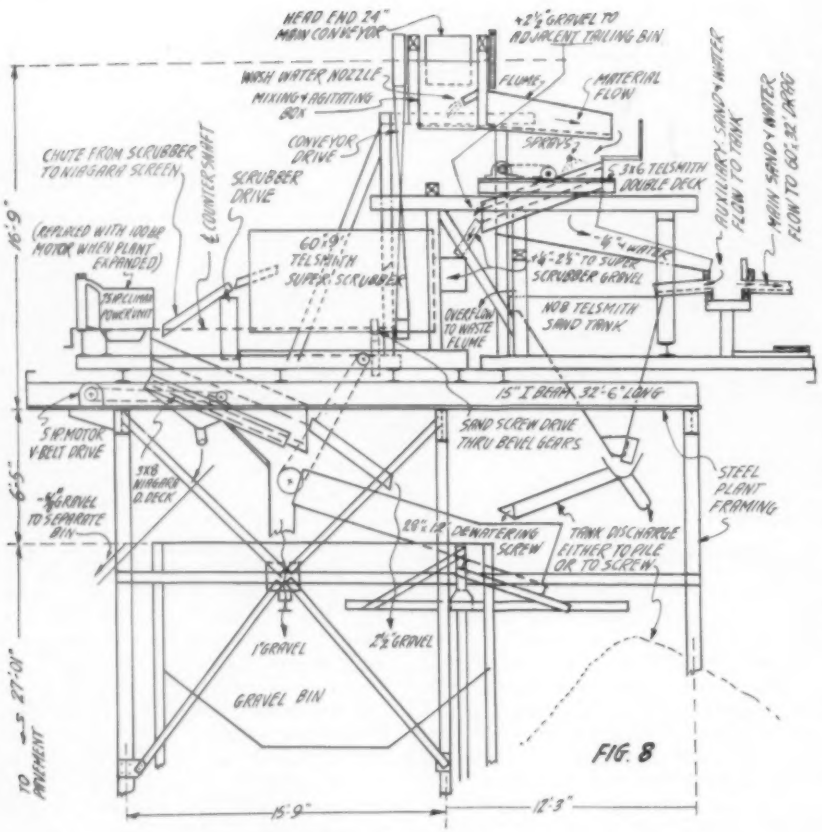


Fig. 8. Main plant design and layout of equipment

original plant, so a 500-ton sand bin was constructed, as shown in Fig. 1. Sand and water from initial vibrator in the main plant were flumed to a sand drag, mounted on a steel framework extension from main plant, with an auxiliary connection to the original sand settling tank to handle surges when in-put percentage of sand ran higher than normal. An interesting operating feature was the division of the sand bin into two compartments, so that the loaded side could drain, while the other side was being loaded by an adjustable spout from the drag. With this arrangement, drained sand can be delivered direct to trucks at a considerable saving over the re-handling expense necessitated by stockpile draining. In addition, a truck tunnel gravel loading storage platform, providing for an extra 400 tons live capacity, was built at right angles to the main bin, and gravity fed to chutes from the 3- x 8-ft. screen, with facilities for either power scraper or crane handling to platform, or from platform to stockpiles. Large batching requirements made necessary a bulk cement supply, and a 300-bbl. bulk cement bin and railroad car unloading plant, with a capacity to unload a car in four hours. was erected next to the railroad, as shown in Fig. 9. The cement carriers for the batch trucks were illustrated in ROCK PRODUCTS, page 82, January, 1938.

In operation, this modern plant is capable of handling 125 to 150 tons per hour of clean, accurately graded, sand and gravel, with as high as 45,000 tons having been shipped out in one month Transit-mixed deliveries are made from the 300-ton batch bin in the auxiliary plant, batched deliveries for concrete road work are made from the 75-ton three-compartment, batch bin, shown in Fig. 1, and bulk sand and gravel deliveries from plant bin and tunnel facilities previously described. To assure a high standard of service to consumers, the owners operate a large fleet of trucks, a part of which is shown in Fig. 9. Production of grades, which may at a particular time exceed amount of deliveries of these grades, is stockpiled by truck or power scraper, and will be reclaimed by crane or bucket loader as and when required.

The plant was built and is being operated by the Gwynns Falls Stone Corp., under the personal direction of President Bruce S. Campbell. Other executives include H. Guy Campbell, treasurer; Robert F. Porter, sales manager; Raymond Kellner, resident engineer in charge of construction, and Warren Frantz, plant superintendent. Associated companies of the Gwynns Falls Stone Corp., include Harry T. Campbell Sons Co., and Texas Supply Co., of Towson, Md.

TABULATION OF CEMENT BATCH PLANT EQUIPMENT

Equipment	Make	Model No. or Size	Power Source	Transmission
Batch bin	Blaw-Knox	75-yd., 3 comp.		Roller chain
Cement bin	Blaw-Knox	300-bbl. cap.		
With screw feeder, enclosed elevator	Link-Belt	4 hrs. to unload car	3¼ x 4 Hercules gasoline engine	
Agitating air supply	Curtis	Compressor		
Rehandling crane	Link-Belt	K-35 and K-25	Wisconsin gas. engine	
Power scraper	Beaumont	½-yd. V-type	Hercules gas. engine	Chain
Scales	Howe	25-ton		

SOUTHERN SAND AND GRAVEL CO., Selma, Ala., is operating a new plant and hauling washed sand and gravel to the site of the old plant in Selma for storage and retail delivery. The new plant is a pumping operation, with a 10-in. Amsco pump delivering excavated material to the screening plant. The new dredge is 30- x 28-ft. in plan. The pump, with a 10-in. suction, is driven by a 150-hp. electric motor, and pumps material through an 8-in. line reduced from a 10-in. line at the boat. The pumped material enters a de-sanding box where concrete sand and mortar sand pass through stationary screens to settling tanks. The gravel is sized over a 4- x 12-ft. Tyler-Niagara triple-deck vibrating screen, and storage is in three steel bins, each with a capacity of about 60 tons. Capacity of the plant is about 30 cars in 10 hrs. In order to reduce the pumping head, a cut was made for a truck runway and the plant was built with foundations about 18-ft. below the normal ground level. The present vertical lift is 32 ft.

ALLIED GRAPHITE CORP., chartered under Tennessee laws, is now constructing a plant in Shelbyville for the production of all kinds of graphite and crayon leads for use in wood and mechanical pencils. This corporation was formed by the American Crayon Co., Sandusky, Ohio; the Empire Pencil Co., and the National Pencil Co., both of Shelbyville, Tenn.

Puerto Rico Cement Plant

(Continued from page 38)

x 16-in. bucket type. Screw conveyors, 16-in. diameter, are used throughout the plant in order that conveyor replacements and spare parts may be reduced to a minimum. The conveying equipment was furnished by the Webster Manufacturing Co., and the Weller Manufacturing Co.

All speed reducers are Falk, and are of similar size as far as possible in order that they may be interchangeable and inventory of replacement parts reduced.

The office is a one-story building at the northeast end of the plant and contains a manager's office, a foreman's office, an accounting office, and a complete chemical and physical laboratory for control and test of operation and for research work.

The plant water supply system consists of a 50,000-gal. concrete reservoir 100 ft. above the plant, and water is furnished by a 350-gal. per min. deep-well pump. This is for plant use, drinking water, etc.

The fuel is a heavy grade Bunker "C" fuel oil, stored in a 10,000-bbl. steel tank. Necessary oil heaters, boilers, pumps, etc. are furnished for unloading and pumping the oil to the kiln storage tank of 4000-gal. capacity. Fuel oil will be delivered by tank cars on the railroad and pumped into the oil storage tank. It is possible that if future developments require increased capacity in the plant that an oil storage tank of sufficient capacity to hold a shipload of oil somewhere between 75,000 and 90,000 bbl., together with the necessary pipe lines and pumps will be provided.

Personnel

The force required will probably be 100 men of which 30 are required in the quarry on account of using hand labor in loading.

Work was started January, 1937. The plant will probably start operation the latter part of May.

The original promoters of the idea of the cement plant were Rafael A. Gonzalez, C. E., Antonio Luchetti, E. E., of Puerto Rico and Dr. Ernest H. Gruening, director of insular affairs and administrator of the Puerto Rico Reconstruction Administration until June, 1937. The design, construction and all contracts except the last one were awarded under his administration. Maj. Edwin C. Eckel, chief geologist, and Ernest Spain, assistant chief geologist, Tennessee Valley Authority, had charge of the investigation for the selection of the raw materials.

Maj. Charles F. Lewis, works manager, Volunteer Portland Cement Co., Knoxville Tenn., was consulting engineer and drew up preliminary plans and specifications and was advisor on the work.

Detailed designs and final specifications were drawn up by the procurement division of the U. S. Treasury Department in Washington, D. C., working with and under the supervision of the writer. Maj. N. Max Dunning represented the procurement division and his advice and suggestions were very valuable in all the work.

P. N. Rylander, general manager, M. A. Long Co., handled the details of the work of his company; A. O. McCurdy was his superintendent. Sidney Lewis, president, handled the Viking Construction Co. contract; George Erickson was his superintendent.

The Puerto Rico Iron Works, Ponce, was subcontractor on fabrication and erection of steel buildings. The Abarco Co., San Juan, was subcontractor on machinery erection.

The Hon. Harold L. Ickes, Secretary of the Interior and Director of the Puerto Rico Reconstruction Administration, and Miles H. Fairbanks, Assistant Administrator in Puerto Rico, are in charge of the project, which in due time will be turned over to the Insular Government of Puerto Rico.

The Insular Government of Puerto Rico will then continue to operate the plant for its own and private local requirements for construction purposes throughout the Island of Puerto Rico. The operating company (under the Insular Government) is called the Puerto Rico Cement Corp. It was incorporated February 19, 1938. Directors include the Governor of Puerto Rico, the Insular Commissioner of the Interior, Insular Director of Utilization of Water Resources. Col. Manuel Font, M. Am. S. C. E., is general manager.

New Ready-Mixed Concrete Plant

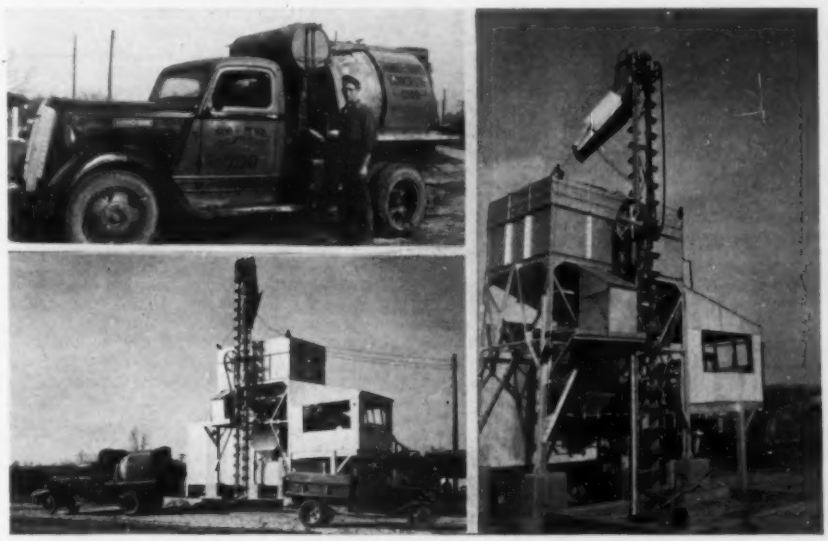
TRANSIT-MIXED CONCRETE CORP., Logansport, Ind., organized September 30, 1937, has built a modern steel and concrete batching plant and has four 1½-cu.yd. Rex Moto Mix units, three of which are on Chevrolet and one on a Dodge chassis.

The batching plant has a 60-cu.yd., two-compartment Butler bin and weighing hoppers. Aggregates are elevated by bucket elevator from a concrete bin, constructed alongside of the plant, with the top of the walls slightly above the ground level. The plant has a daily capacity of 100 cu.yd. of concrete.

In addition to the central plant in Logansport, a portable plant is available for large jobs located a considerable distance from the city. One of the larger jobs for which concrete was supplied by the portable plant was for bridge construction at Lockport, Ind., that called for the production of 4000 cu.-yd. On jobs using the portable plant, a crane handled the aggregates.

John A. De Grief, president of the company, also heads the San-Gra Stone Co. F. J. De Grief is vice-president; E. C. De Grief, secretary-treasurer; B. B. Coppock, superintendent; and J. A. De Grief is in charge of purchasing. Both John A. De Grief and B. B. Coppock were formerly with the Greenville division of the American Aggregates Co.

Views of new batching plant and one of the transit-mixed concrete trucks



U. S. Government Cement Requirements

No Bids East—Contracts Let West

PORTLAND CEMENT manufacturers in the East refused to submit any bids on an f. o. b. mill basis on cement contracts for deliveries in Ohio, West Virginia and New Jersey, under the procurement division of the U. S. Treasury Department scheme to buy all government requirements direct. Various letters accompanying the returned blanks stated that the f. o. b. mill price requirement in the contracts disrupts ordinary channels of cement distribution by placing the producers in a position where they are bidding against each other at prices equal to actual production costs and leaving them at an unfair disadvantage in competitive bidding.

They asked that the former basing point system again be used. However, Treasury officials said that in their opinion the former system gave producers an opportunity to control bids and resulted in monopolistic practices. The Department of Justice has advised them, the officials said, that identical bids received under the basing point system were outward evidence of collusion and for this reason the Treasury was obliged to reject them.

On the West Coast, the government asked for bids on 250,000 bbl. in paper sacks for use on all projects in California, shipments to be at the rate of approximately 40,000 bbl. per month. Bids for standard portland cement were: Monolith, $1.63, less 10c discount in 30 days; California, $1.64; Riverside, $1.80; Calaveras, $1.90; Pacific $1.98, less 10c discount; Santa Cruz, $2.00. Announcement was made that the contract was awarded to Monolith, but it is believed that other companies will share on a lowest delivered price basis.

For use of the federal government in Oregon, Utah, Colorado and Texas bids on 2500 bbl. were received as follows (f. o. b. mill or f. o. b. point of storage): Oregon, $2.00 (mill); Santa Cruz, $2.00 (storage or packing plant); Union (Utah), $2.60 (mill); P. C. of Utah, $2.70 (mill); Colorado, $2.50 (cloth), $2.25 (paper); U. S., $2.50 and $2.25; Monolith Midwest, $2.60 (cloth).

Objections Stated

Riverside Cement Co., by G. A. Bostall, president, accompanies its bid with the following letter of protest:

We enclose proposal and bid in response to your invitation of April 29, 1938, relative to the furnishing of Portland Cement, as therein specified, for use by the Executive Departments of the Federal Government in California.

You will note that we have annexed the following as a condition to such proposal and bid:

"This proposal and bid are wholly conditioned upon approval by the Comptroller General of the United States as to the legality of the within invitation, as being in compliance with Revised Statutes, Section 3709 and other pertinent U. S. Statutes, otherwise, said proposal and bid are to be deemed withdrawn in toto."

We do not desire our position in this matter to be misunderstood. This Company has always been willing to supply its products to the Government, upon an F. O. B. mill basis, and it is now willing to do so. It has always coöperated with the Government in enabling the latter to secure the benefit of land grant or other special rates, and it is now willing to do so.

Correlatively, it is the understanding of this Company that it is a positive duty on the part of Procurement Officers to secure the lowest available rate upon any movement of Government supplies or materials, otherwise, the Government and its supporting taxpayers would be deprived of a benefit to which they obviously are entitled. This means that in determining the cost to the Government of a given commodity at a given point, there must be taken into consideration two things: First, the cost of the commodity at the shipping point, and second, the cost of moving the commodity to the point of use.

In this connection we understand that the Comptroller General has repeatedly ruled the delivery cost to Government is always a matter of consideration in determining which, in fact, is the lowest bid received in a given invitation, likewise, that the public interest, as well as fairness to all bidders, requires that bids be requested on the basis of both F. O. B. bidders shipping point and F. O. B. Government destination. This is in order that the Government having regard for other Government advantages available in such connections may accept that bid which will result in the lowest net available charge against public moneys. 16 C. G. 21; 16 C. G. 150; 16 C. G. 698; 16 C. G. 729; 16 C. G. 815.

Now let us apply these principles to the present invitation. Specified quantities are desired over a six months' period, in the future. Having in mind the above principles laid down by the Comptroller General, two questions immediately arise. These are, first,—will the Government know at the time of making the award where this cement is to be used, and, second, if it does know that the cement is to be used on certain definite projects, will it know as to each such project what quantities will be required during the month or months for which contracts are awarded.

If either of these questions be answered in negative (and experience as well as paragraph 17 (C) of these specifications teaches us that one of them must be), it necessarily follows that, at the time of making the award, the Government will be wholly unable to determine its delivered cost. Hence to recur to the holdings of the Comptroller General, it will be impossible for the Government to determine which bid will result in the lowest net available charge against public moneys.

Under the present specifications delivery is restricted to F. O. B. cars at mill. By this restriction the Government has denied itself the benefit of truck rates, established by Railroad Commission of State of California, applicable from points of production to point of use. Only infrequently is the point of use at a railhead destination; usually drayage to the job beyond railhead is involved. However, the Government assumes that drayage costs, from railhead to point of use, will be the same for any brand of cement and, that a comparison of destination costs can therefore be made on an F. O. B. railhead basis. This assumption may be justified in some sections of the country but it is not justified in any section where published truck rates offer the lowest total transportation cost from the mill to point of use. In southern California the published truck rate from mill to point of use is frequently less than the sum of the Land Grant Freight Rates and the drayage beyond railhead. Unless the Government so draws its specifications as to make this comparison for each of the undisclosed destinations under this proposal, this situation may prevail by its refusal to utilize published truck rates the Government will have increased its delivered cost at point of use. Accordingly we have modified the bid form and offered our cement F. O. B. cars, or F. O. B. trucks at mill.

Several cement companies in southern California operate plant facility trucks, that is, trucks engaged solely in transporting cement manufactured and then owned by a particular company from the mill of that company to point of use. Transportation charges for such movement by plant facility truck are not subject to regulation by the Railroad Commission. A cement company is therefore privileged to haul its own cement for less than the rate established by the Railroad Commission for contract carriers. But the Government by restricting delivery to F. O. B. cars at mill, under the present specifications, has deprived the cement company of this privilege and correspondingly deprived itself of any benefit thereunder.

We are not attempting to inform the Government how its affairs should be conducted. We are, however, properly interested in receiving payment for such cement as, we see, payments for supplies and material furnished the United States Government requires the approval of the Comptroller General as to the legality of the charges against public moneys, and the Comptroller Gen-

eral has on several occasions indicated that destination cost must be considered in determining the lowest bid. For the reasons outlined in this letter, and for our own protection, we have limited the enclosed bid so as to require submission of the question to the Comptroller General before, rather than after, acceptance of the proposals.

Dealers Protest

At its recent annual convention in Washington, D. C., the National Retail Lumber Dealers Association adopted the following resolution:

WHEREAS, the trend in recent purchasing policies of the Procurement Division of the United States Treasury Department has indicated a tendency to centralize purchases and to incorporate provisions in the invitations for competitive bidding which have never before characterized the governmental purchasing requisitions in its desire to secure an unrestricted range of competition in purchases where federal funds are to be used in whole or in part, and

WHEREAS, the policies thus inaugurated actually result in restricting the range of competitive bidding, and

WHEREAS, we believe this policy to be unsound and uneconomical, and

WHEREAS, this policy defeats the purpose for which it is intended because it does not necessarily mean that merchandise purchased at point of manufacture is being delivered at the lowest cost to the site of the project. Therefore, be it

RESOLVED, that we, the members of the National Retail Lumber Dealers Association, in convention here assembled, representing 25,000 retail lumber and building material dealers, vigorously and emphatically protest, as small business men, the action of the government in calling for bids direct from the manufacturers f. o. b. their plants. Since the foundation of this country, it has been built up by the small retail lumber and building material merchant. He has maintained adequate stocks, warehoused materials, and employed many thousands of employees. Mass buying by the government direct from the manufacturer will necessarily throw thousands of present employees out of work. It furthermore destoys the most economic system of distribution, as proven by years of practical experience. Be it further

RESOLVED, that a copy of this resolution be sent to the President, each Senator and Representative in Congress, and the United States Treasury Procurement Division.

ASHLEY AND STRINGER, Franklin, Tenn., have obtained for an undisclosed client, option on 2000 acres of phosphate property along Liberty and Murfreesboro pikes, east of the L. & N. R. R.

IDAHO state officials, including the governor, are advocating establishment of a U. S. Government owned and operated plant to treat local phosphate rock for fertilizer. The corner of Utah, Montana and Wyoming contains the largest deposits of rock phosphate known.

Lehigh To Rebuild Two Plants

AFTER SERIOUS CONSIDERATION of the several problems presented and, despite the gloomy outlook for the immediate future of the business, the Lehigh Portland Cement Co., Allentown, Penn., has decided to continue the program of rehabilitation inaugurated in 1934 and will promptly proceed with the complete modernization of its Union Bridge, Md., and Alsen, N. Y., plants.

It may be recalled that during the last depression the company abandoned three of its plants in the Lehigh District and wrote off the net assets of these plants against surplus. Although all obsolete machinery and equipment at these plants was sold for scrap, all units of recently purchased machinery and equipment have been preserved for future use. Although the art of cement manufacture is constantly improving, many of these units are as modern and as efficient today as they were six or eight years ago. Wherever any of these units can be utilized in the layout of the improved plants they will be substituted for machinery that would otherwise have to be purchased on the market.

The Union Bridge plant was formerly the property of Tidewater Portland Cement Co., the assets of which were purchased at Receiver's Sale in 1925. Although this mill has been operated more or less continuously by Lehigh ever since, only such improvements as were absolutely essential to the operation of the plant were made. It is now proposed to modernize the plant completely and raise its efficiency to a parity with other Lehigh mills.

The Alsen plant, formerly owned and operated by Hudson Valley Portland Cement Co., was also acquired at Receiver's Sale in 1925 but, because of rapidly declining demand in the Northeast, was operated by Lehigh for only three years after the date of purchase. The present building, docks, and storage facilities are still in good condition and will be utilized to whatever extent is possible in the layout of the modernized plant. Certain units of machinery and equipment which were installed shortly after Lehigh bought the property will form the nucleus around which the new plant will be built. The plant is designed for dry process and power will be generated from waste heat.

Rehabilitation of both plants will proceed simultaneously. Since many departments must be entirely re-equipped at Alsen, it is not likely that the rejuvenated plant can be put into operation much before the close of 1939. Work at Union Bridge will be synchronized with operating schedules so that there may be no interruption of production or shipments. The major installations of additional machinery and equipment will be done during the period of usual winter shutdown and present plans indicate that the mill when modernized will resume operations in the Spring of 1939.

Because surplus machinery and equipment now on hand can be readily utilized and because no new buildings will be required, it is contemplated that the work can be done at a new low figure for cement mill reconstruction.

STURM AND DILLARD CO., Circleville, Ohio, having exhausted most of the available sand and gravel above the water table in its present workings, is building a large steel dredgeboat and will start pumping operations late in June.

The new dredge, 69 ft. in length, will be floated with large steel pontoons and has a 65-ft. Swintek cutter. The pump is a 16-in. Amsco counterflow pump, which will be operated with a 16-in. suction and a 16-in. discharge. The pump will be direct-connected to a 600-hp. motor operating at 2200 volts, and the drive shaft will run in an Amsco self-aligning thrust bearing. The suction pipe will be operated by a 5-drum Clyde hoist.

Capacity of the pump in this deposit is estimated at 250 to 300 cu. yd. of sand and gravel per hour, which is about the same as with the excavating methods to be discarded. Excavation has been by shovels and clamshells into industrial cars with haulage by locomotive to the plant and elevation by skip hoist to the screening plant. The screening plant will not be changed.

NATIONAL GYPSUM CO., Buffalo, N. Y., in connection with the sale of its $3,500,000 bond issue, announces intention to build a new $900,000 plant for gypsum products, including wall board, at some point on the Southern Atlantic seaboard, to use gypsum rock from Nova Scotia. The location has not been disclosed. Improvements and reconstruction costing nearly $1,000,000, at the company's Fort Dodge, Iowa, plant are practically complete.

MOULDING-BROWNELL CORP., Chicago, Ill., crushed stone producer, was recently placed in receivership and all operations were suspended by the receiver. The company's principal quarry is at Thornton, Ill., on the Illinois Central R.R. It was formerly the Brownell Improvement Co.

After 36 Years of Organized Effort the

Lime Industry Looks Ahead

By NATHAN C. ROCKWOOD

DEPRESSION is not going to check the efforts of the National Lime Association to promote the business of its members. The annual meeting at Cincinnati, Ohio, May 9, 10 and 11 resulted in voting approximately the same budget for the year beginning July 1, 1938, as for the year ending that date. Also all the officers were reëlected. They are S. Walter Stauffer, president and general manager; Henry LaLiberte, Duluth, Minn., chairman of the executive committee. The other members of the executive committee are J. M. Gager, Chattanooga, Tenn.; Reed C. Bye, Philadelphia, Penn.; G. J. Whelan, Cleveland, Ohio, and B. L. McNulty, Chicago, Ill.

S. WALTER STAUFFER, president, in his opening address on "Responsibility of the Individual in Association Activities," stressed the importance of a better understanding of Americanism, beginning with a reading of our Constitution. He said that all of us, as business executives, were partly responsible for present government excesses. "We have sought special favors," he said, "we have winked at special favors, until it has become the common belief that government exists solely for the purpose of supporting the people. During the past few years minority groups have sought and received ever greater benefits from government, both federal and state, always at the expense of individual freedom." He made a plea "for a return to individualism, individual initiative, individual honesty and individual responsibility."

Particularly did Mr. Stauffer emphasize the human element. He said in part: "Above everything else, we must have men. Even management is nothing more or less than men. Today we hear a great deal about capital and labor. Capital is spoken of as though it were a living thing, with a conscience, or mostly without one, with a will and as having the ability to choose between the right and wrong. Labor is referred to en masse and not as an individual. It is supposed to include, as a group, all those that work in mines, quarries, factories and on construction. But capital does not have life. It may be money, it may be land, it may be a building. It cannot conceive good, neither can it do evil. It is subject to the will and conscience of men. Neither is labor a commodity and like commodities subject to purchase in a competitive market. Labor is men, the same kind of men that are responsible for management, the same kind of man that you and I are. Labor is a human being with a heart, with a soul and with a brain, with ideals and with aspirations, with perfections and with faults.

"The thing I am trying to say is, that whether our industry meets its obligation to society or not depends on men. Whether your own company is a success or failure depends on men. Whether the National Lime Association serves the industry well or not depends on men. Is it not clear, therefore, that each one of us has an individual responsibility in these matters? It has been said that a chain is no stronger than its weakest link. If one of us fails to assume our individual responsibility does it not follow that our whole industry is, therefore, weakened?"

MYRON S. HAZEN, manager, service division, American Agricultural Chemical Co., speaking on "Mutual Responsibilities and Interests of the Lime and Fertilizer Industries," must have caused those whose memories go back a few years to do a little reminiscing. Not so long ago the fertilizer industry fought the use of lime. Now it is admitting that without some lime a good many soils can't make use of fertilizers. His paper will be published in ROCK PRODUCTS for July.

P. H. BATES, chief, clay and silicate products division, National Bureau of Standards, Washington, D. C. made an "off the record" talk on "Research," quoting largely from the paper read by Prof. C. H. Scholer at the National Sand and Gravel Association convention at Memphis, Tenn., December, 1936, as to the meaning and objectives of research. Mr. Bates said this couldn't be better done than it was by Prof. Scholer. He accompanied these excerpts by running comments of his own, which were interesting and pointed.

Baltimore Studio

"Old Timers"—Standing, left to right: Fred Witmer, Wm. F. Stolzenbach, D. S. (Bud) Hunkins; Seated, left to right: Irving Warner, James H. McNamara, J. M. Gager

Lime Use in Construction

PROF. WALTER C. VOSS, Massachusetts Institute of Technology, brought the results of his investigations of lime in construction to date in an address, illustrated by lantern slides, on "The Important Characteristics of Lime in the Construction Industry." This paper gives much new and valuable data on the yields of lime putty. His conclusion is that the amount of lime solids in a cubic foot of putty is approximately the same, if the putties have the same weight per cu. ft. From this fact he has worked out a formula for determining lime solids in any putty, so that mortars can be accurately specified on a lime solids basis. Prof. Voss' paper will be published in a later issue. The paper also contains his theory on the use of lime in concrete.

F. D. BICKEL, technical representative, E. I. duPont de Nemours & Co., gave a comprehensive review of various blasting explosives now available, and their special uses and virtues, in a paper en-

titled "Primary and Secondary Blasting in Limestone." Doubtless this information is readily available in the handbooks on blasting, published by the powder companies, but Mr. Bickel's paper is an excellent summary, and space will be found for it in a later issue.

Spalls at Lime Plants

DR. OLIVER BOWLES, U. S. Bureau of Mines, described studies begun in 1922 by the Bureau to find a use for spalls or small pieces of limestone, often wasted in lime-plant operation. He summarized the problem generally, estimating that 1,000,000 tons of spalls are wasted annually by American lime plants.

VICTOR J. AZBE, consulting engineer, discussed "Burning Lime and Spalls in Vertical Gas-Fired Kilns and Construction of Economical Kilns." A part of this paper is published elsewhere in this issue. The part on burning spalls will be published later in greater detail.

J. K. BILLINGS, superintendent of the Peerless White Lime Co. plant at Ste. Genevieve, Mo., where Victor Azbe has done much of his experimental work, discussed these improvements in shaft kilns. His paper follows that of Mr. Azbe in this issue.

Sales Promotion

For luncheon and an all-afternoon session the Association had as guests architects, engineers and builders of Cincinnati and nearby cities. Prof. Voss explained to them his investigation of mortar.

Safety Promotion

WALTER H. TOMLINSON, assistant mining engineer, U. S. Bureau of Mines, in announcing the winners of the Association's safety contest, reviewed the essentials of accident prevention, especially commending a method of giving bonuses and awards. In one instance he described, awards of theater tickets greatly stimulated interest in safety.

The six lime plants winning safety awards for establishing accident-free records during 1937 were active for nearly a million man-hours. The plants winning the awards were:

Bell plant, Bellefonte, Penn., American Lime & Stone Co., 397,493 man-hours.

Galloway plant, Galloway, Mo., Ash Grove Lime & Portland Cement Co., 252,979 man-hours.

Thomasville plant, Thomasville, Penn., J. E. Baker Co., 99,313 man-hours.

South Chicago plant, Chicago, Ill., Marblehead Lime Co., 97,347 man-hours.

Springfield plant, Springfield, Mo., Marblehead Lime Co. 92,480 man-hours.

Houston plant, Houston, Tex., Haden Lime Co., 31,561 man-hours.

The principal causes of the accidents occurring during 1937 were handling rock and other materials, hand tools, haulage, burns (including lime burns), and falls and slides of rock or overburden. Excluding the two fatal and three permanent injuries, the causes of accidents resulting in the greatest severity per accident were those from falling objects, falls and slides of rock or overburden, haulage, and machinery.

Diesel Power

T. M. ROBIE, manager, Diesel sales, Fairbanks, Morse & Co., Chicago, gave some good arguments for the use of Diesel power as well as an excellent explanation of Diesel engines. An abstract of his paper appears elsewhere in this issue.

DR. WILLEM RUDOLFS, chief, division of water and sewage research, Agricul-

(1) Sam M. Shallcross. (2) Irving Warner, presiding; (3) E. C. Mathias. (4) President S. Walter Stauffer and Dr. Oliver Bowles. (5) Walter Stauffer in a thoughtful mood. (6) The "fighting secretaries," Lon Johnson and W. V. Brumbaugh; (7) Honored Guest from Australia, E. L. Newbigin, and James A. Murray (For the first three photographs the editor is indebted to Arthur C. Hewitt)

tural Experiment Station, New Brunswick, N. J., reviewed in simple, understandable terms "The Use of Lime in the Treatment of Sewage and Industrial Wastes." On the growth of sewage treatment in this country he said that five years ago about 31 percent of the urban population was provided with facilities through some 2900 plants; at present, there are more than 3700 plants. Also much progress has been made in the abatement of industrial wastes. After explaining the part of lime in sewage treatment, Dr. Rudolfs concluded: "That the field of sewage and trade waste treatment is just beginning. Large quantities of lime can be used. The present use of lime has come through research and investigation conducted nearly entirely outside of the lime manufacturers. Either the lime manufacturers did not think there was a substantial market, or thought that a customer using only a few hundred tons of lime a year was not worth while cultivating. It would seem to me that with proper research, stimulation and going after the business, the sale of lime for sewage and waste treatment can easily amount to some 300,000 to 400,000 tons a year."

(Present consumption of lime in this field is probably less than half that.—Editor.)

Growing Old

Some of the old timers objected to the program announcing "the 20th annual convention." The national association in the lime industry is actually much older than this. The name of the predecessor organization was the National Lime Manufacturers' Association. Charles Warner was the only member present who recalled the founding of this parent organization and ROCK PRODUCTS' part in it. (The National Lime Manufacturers Association was founded in November, 1902, at Cincinnati, Ohio. Charles Warner was its temporary president and the late E. H. Defebaugh, publisher of ROCK PRODUCTS, its temporary secretary.—The Editor.)

BASIC DOLOMITE, INC., Cleveland, Ohio, with plant at Maple Grove, Ohio, has made arrangements with Canadian Refractories Ltd., for the manufacture and sale of the latter's products in the United States and Mexico. D. W. Stewart, former manager of sales of Canadian Refractories, has become vice-president of Basic Dolomite.

CALIFORNIA PORTLAND CEMENT CO., Colton, Calif., on January 29 shot what is claimed to be the largest quarry blast yet made in California—about 90 tons of explosives. Coyote holes or tunnels were used to load the explosives.

Trends—As Evidenced by Purchases

MERRICK SCALE MANUFACTURING CO. made an installation in April of a Weightometer at the plant of the Olympic Portland Cement Co., Bellingham, Wash., to insure accurate automatic control of the amount of clinker ground. There being no belt conveyor available for the usual type of installation, an ingenious combination was installed, consisting of a Weightometer complete with a short pivoted conveyor, using a 24-in. wide flat belt, about 12 ft. centers, and with a capacity of about 70 tons per hour. The weighing belt is installed below a clinker supply bin and discharges to a Link-Belt drag-chain conveyor. Gypsum rock can also be handled over this same equipment.

STEPHENS-ADAMSON MANUFACTURING CO., reports the sale to the Mulberry Supply Co., for the Amalgamated Phosphate Co., Oakridge, Fla., of ten 5-x10-ft. single-deck vibrator screens of the suspended sub-frame type with pantagraph stabilizers and closed bottom plates for discharging water and fines. These screens are used for separating out sized rock phosphate in a washing process.

SCREEN EQUIPMENT CO. reports the following recent installations of its new Seco vibrating screens: B. C. Perkins, sand and gravel producer, Ithaca, N. Y., installed a triple-deck screen. B. C. Hedrick Gravel & Sand Co., Lilesville, N. C., is installing two 4-x12-ft. triple-deck screens. Virginian Limestone Co., Ripplemead, Va., installed a 4-x12-ft. triple-deck screen for washing stone. Buffalo Slag Co., Buffalo, N. Y., installed a 5-x16-ft. double-deck screen in its plant No. 2 at Lackawanna, N. Y. Philadelphia Slag Co. of Swedeland, Penn., recently installed a 4-x14-ft. single-deck scalping unit. J. E. Redman Sand & Gravel Co. of Rochester, N. Y., is opening up a limestone quarry, and installing, among other equipment, three Seco screens. Crushers and other material for this plant were bought recently by this company in South Carolina.

CHICAGO BRIDGE & IRON CO. reports shipment of a standard two-tank Brooks-Taylor lime putty plant to the State Sand and Gravel Co., Indianapolis, Ind.

TRAYLOR ENGINEERING & MANUFACTURING CO. reports increasing interest in all-welded ball and compartment mills, kilns, coolers and dryers. This company built its first all-welded units, (two 9-x160-ft. rotary kilns) in 1933. To date the company has furnished in all-welded design, three large compartment mills, 12 rotary dryers, 20 rotary coolers and 32 rotary kilns, the latter ranging up to 11 ft. 3 in. diameter by 400 ft. long. By "all-welded" is meant that not only are the shells welded, but also the riding rings, gears, bearing bases and other parts that are adapted to this type of construction. To do this the company has had to design and build unique machines and devices for welding cylinders, etc.

F. W. WELCH ENGINEERING SERVICE reports the sale to the Marble Cliff Quarries Co., Columbus, Ohio, of a 28-in. x 30-in. roll crusher, equipped with special high carbon, heat-treated, steel shells, which can be machined or ground when worn. The crusher is to be used to reduce ½ to ¾-in. limestone to minus ¼-in. The Welch Service recently installed its second unit of this type at the Ohio Hydrate & Supply Co. plant at Woodville, Ohio. This is equipped with a special electrical device for keeping the rolls in condition for fine crushing. Brewer and Brewer Sons Co., Chillicothe, Ohio, recently installed a 25½-x 30-in. Welch corrugated roll crusher.

EAGLE IRON WORKS reports the sale to the Bedford-Nugent Co., Inc., Evansville, Ind., and to the Sturm & Dillard Co., Circleville, Ohio, of Eagle Swintek chain type cutters for sand and gravel dredges. Another soon to be installed is for the Missouri Portland Cement Co.'s Memphis, Tenn., sand and gravel plant. Northwestern Gravel Co., Lakeview, Ia., recently purchased a second Eagle double-screw washer with shale remover attachment.

NATIONAL SUPPLY CO. reports the sale of a 350-hp. Superior Diesel engine, direct-connected to a 187-k.v.a. electric generator, to the Charles Stone Co., Chester, Ill. This installation is of particular interest because, in addition to driving the generator, the engine drives an air compressor and a rock crusher through a system of belt drives that are clutch connected. The installation replaces purchased electric power.

PRODUCTIVE EQUIPMENT CO. reports the installation by the Marquette Cement Manufacturing Co. at Oglesby, Ill., of a number of Selecto vibrating screens for scalping the finished product prior to bagging and delivery to pumps for bulk shipment.

LEE TRANSIT MIXER CORPORATION reports two new ready-mixed concrete plants using its equipment: Carl Glesing Co., Indianapolis, Ind., using two mixers; Independent Sand & Gravel Co., Cincinnati, Ohio, several units.

Interesting Developments In

MODERN TYPE VERTICAL LIME KILNS

By VICTOR J. AZBE*

PEERLESS WHITE LIME Co's plant, St. Genevieve, Mo., was the first lime plant I ever studied, and the first paper delivered before this organization (National Lime Association) 15 years ago was based on work in connection with this plant. In many respects, the Peerless plant shows better the changes that took place in the lime industry during these years than many other plants.

Performance in this plant during the years 1920 and and 1921 was as follows:

	1920	1921
Lime Produced	29,113	16,235 tons
Kiln Coal	11,564	7,645 tons
Boiler Coal	2,160	1,620 tons
Lime Per Kiln Per Day	....	17.1 tons
Fuel Ratio Kiln, Coal Only	2.52-1	2.14-1
Fuel Ratio Kiln and Boiler Coal	2.12-1	1.76-1

Although the results were poor, capacity was better than that found in the average plant for those days. At the time virtually no technical information was available on the subject of kilns, their design and performance, and the trial and error method was the usual procedure. The Peerless company, however, decided to go ahead with plans for new kilns.

In 1925, two new kilns were designed to produce 40 tons of lime per day per kiln. The kilns were built, and a modern gas producer, for these days, was installed. It was a beautiful plant on paper, but not at all beautiful when it went into operation as the promised capacity was not realized, kiln life was short, and core was a serious problem. A year later, however, the kilns were producing 50 tons of lime per day, which was considerably more than promised, and they functioned at that rate for many years. The change, which turned the kilns from a failure to a success, was merely the introduction of a center wall into the shaft to hold up the weak middle section allowing time to properly trim the kiln.

However, these kilns were very large; the shells were 16 ft. in diameter and they were unusually high. In the latter years, considering their great bulk, the kilns were not doing anything very exceptional even though they exceeded original promises of performance. In addition, the fuel ratio, while fair, could not be considered as good. Draft was then increased and that helped some, but other kilns built since that time, although much smaller, had a capacity quite as great. It appeared that the kilns were to remain monuments to misplaced effort.

In the meantime, the center burner was coming into the picture; first in a very crude form in Louisiana, then as a real success in an elaborated form at Glen Park. But this was all with natural gas, and one can do things with natural gas that are impossible with producer gas. The Moosehorn Lime Co. in Canada tried burning with producer gas exclusively using a center burner, and it is a success.

In view of this new experience, changes were again undertaken on the Peerless kilns. They were quite radical in design but not at all costly, and were successful from the very beginning.

Change Burner To Improve Efficiency

These kilns always had a double firing level. The upper level (Fig. 1) was left as it was with gas entering through the side walls of the shaft. However, the lower level wall burners were bricked up, and gas was brought in from two ends to a center burner in the middle of the shaft. This center burner has 24 gas openings which, together with the side openings, makes it difficult for air from the cooler to penetrate the hot zone without doing its share of work.

The kiln was placed in operation and capacity improved immediately, increasing from 65 to 80 tons daily, except on Saturdays when the flues were blown, and even then it did not drop below 70

*Abstract of paper presented before the recent annual convention of the National Lime Association.

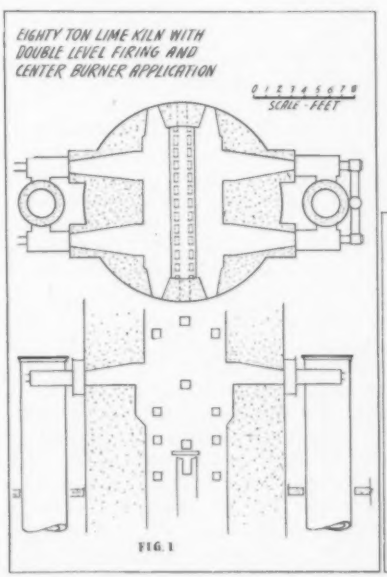


FIG. 1

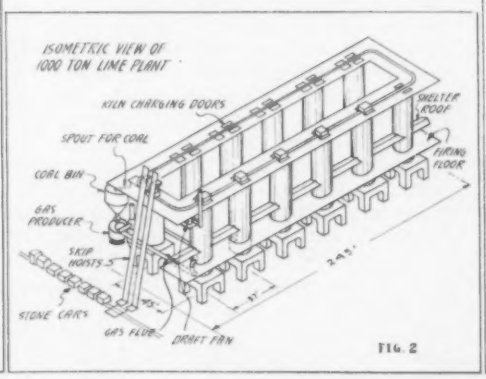


FIG. 2

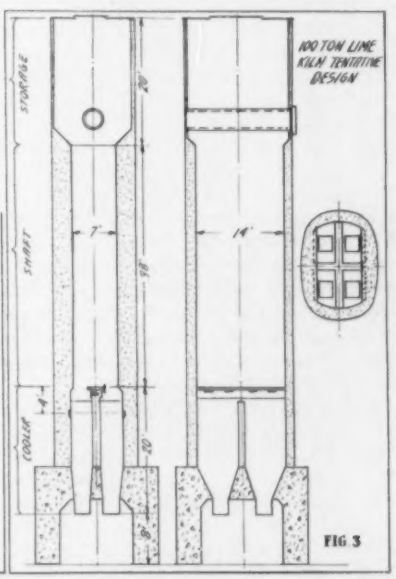


FIG. 3

Fig. 1: Eighty-ton lime kiln showing the design of the double-level firing and center burn application. Fig. 2: Isometric view of what a 1000-ton lime plant would look like. Fig. 3: Tentative design of a 100-ton lime kiln on which patents are pending.

tons. This was on the first of the two large kilns. Soon the second was similarly changed and, as it had a better fan and over 4-in. draft in the kiln, it performed even better, one day having a capacity of 86 tons, the next 80 tons, proving that it was not overdrawn the previous day.

These kilns, built for a 40-ton daily capacity, are now producing twice the amount promised. Instead of a ratio of a little over 2 to 1 in 1920, it is now close to 5 to 1. Right now the kilns produce just about 160 tons of lime daily, which is more than all eight of the old kilns ever produced. The kilns produce over a ton of high calcium lime per square foot of shaft area, holding the world's record.

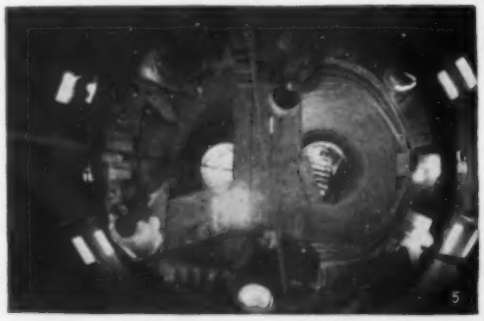
Possibilities of Larger Kilns

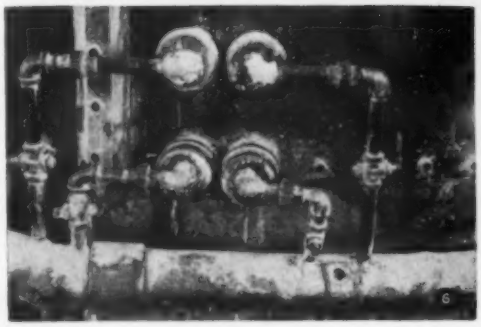
Today, it is easier to build a 100-ton kiln than it was to build 40-ton kilns in 1925. If the knowledge available today had been accessible when these kilns were built, they could readily have been made to produce 100 tons daily, with less height, less steel, less brick, and less concrete; in short the entire construction would have been far more economical. The many trials and their errors and successes were not for nothing. Today kilns, such as Fig. 1, would have to produce 100 tons per day, and a 1000-ton plant is a practical possibility, Fig. 2.

Present knowledge not only permits making kilns larger but provides for proper distribution of this capacity. Today, we are concerned as much about the design of a proper cooler as we used to be about the design of the entire kiln. Other considerations include: proper shape of shell; proper thickness of brick; design of cooler; design of hot zone, preheating zone, and storage zone; proper method of gas generation, gas introduction; draft creation and draft control; and facilities for regulation of temperatures.

The whole problem is further complicated by variables. Some stone, for example, is very hard to damage by high temperatures, another is extremely sensitive. One will hold its body too well, resulting in a loose kiln; another may break all up and block the draft. Then there is the variable of personnel from the president down to the kiln fireman. The reason why Peerless kilns worked out so well is that the superintendent and "Bunk" Wm. Beckerman, the lime plant foreman, were determined to get results.

However, large kilns are not always possible; they would be out of place in many plants. Much can be done today with small kilns. At the last meeting of this organization, the Glen Park, Mo., kiln of Glencoe Lime and Cement Co. was referred to as an example; now the Paul Lime Co. kiln, Douglas, Ariz., takes precedence. This kiln has by far the lowest cost per ton of capacity ever constructed, and at the same time it is a more efficient kiln. The kiln cost $150 per ton of daily capacity, with interest and depreciation, less than 10 cents per ton of lime.





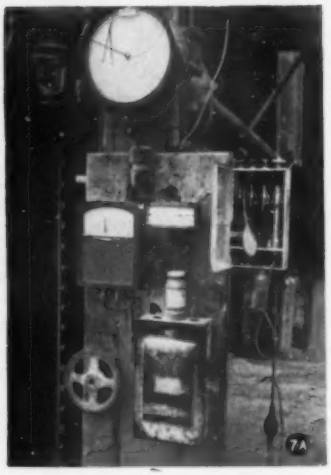


Fig. 4: Paul Lime Co., kiln has simple foundation but with ample strength. Fig 5.: Showing two lime draw outlets and also part to the kiln wall. Fig. 6: Four of the eight natural gas inlets to a center burner. Fig. 7: Completed kiln which is charged immediately after every draw and has no storage zone. Note instrument board below. Fig. 7-A: A close-up of instrument board

The table contrasts dimensions of the Glencoe and Paul kilns. Although the original shell of the Paul kiln was only 12 ft. in diameter, it was shaped so that a 51-sq. ft. shaft could be built in, and one of the factors that determines capacity is the size of the shaft, not the size of the shell. As the rest of the plant determined the kiln height, it could not be made more than a total of 44-ft. If it had not been possible to charge the kiln at night, capacity would have been very low. Night charging, however, was practical in this case, so the kiln was built with a straight shaft, with no storage zone, and the whole plant was geared to a high rate of production.

Another factor which entered the picture was that it was quite easy to get small stone as all rock from the quarry passed through a crusher which was set for a maximum size of 6 in. and a normal size of 4 in. With such small rock in the kiln, the heat absorbing surface was greatly increased, as it is this surface that really counts and not the kiln dimensions. The very small kiln, therefore, became a fairly large kiln as far as output was concerned. A normal low draft production is 40 tons, but the potential capacity is 50 tons, or one square foot per ton, the same ratio as at the Glencoe or Peerless plants.

Construction was economical. Fig. 4 shows the foundation, simple in form and with the strength so distributed that the least amount of concrete was necessary and the most clear space obtained. Fig. 5 shows the two lime draw outlets, and also part of the kiln wall. It should be noted that the space within the shell is mostly shaft, with

no more brick than that needed to protect the steel.

Fuel was natural gas introduced through a center burner, without the usual fireboxes and side burners, which saved a great deal of money. On this account the kiln looks flush on the outside, somewhat like the conventional mixed feed lime kiln. However, the center burner on which a patent is pending, was quite elaborate; gas traveled to eight sections of the shaft, each of the eight streams being under independent control. Four of the eight inlets are shown in Fig. 6.

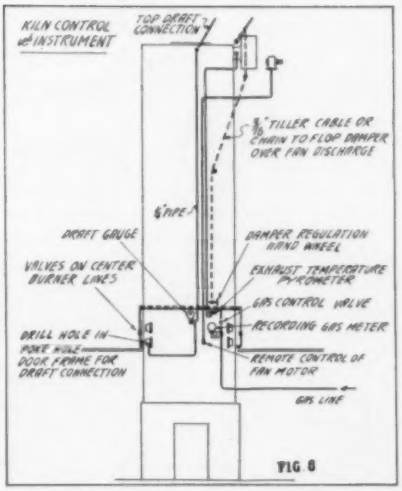
The kiln, Fig. 7, which is charged immediately after every draw, has no storage zone. Although top temperatures are low, missing just one draw would make them impractically high when the fan would have to be shut down, putting the kiln practically out of commission as a producer. The fan is connected as direct as possible to save money for ducts and power.

Although the cost of the kiln is low, no chances were taken and success jeopardized by petty savings, particularly at two important points; one is the fan, and the other is the instrument board. A kiln of such size normally produces about 15 to 25 tons daily. To get double this production would not be possible except that the fireman knew what was going on. The instrument board has a recording gas meter, a duplex draft gauge, an indicating pyrometer, valves and levers so the fireman can adjust the gas or the draft, and if need be, start or stop the fan without moving from the spot, all of which are connected to the kiln as shown in Fig. 8. These instruments cost over $500 for one kiln, but if we can get so much more lime, they are well worth it.

Kiln Efficiency

Gas consumption per net ton of lime in this kiln is 4117 cu. ft. Kiln efficiency is 60 per cent if based on the assumption that the kiln could utilize all heat put into it. At least 10 per cent is unavoidably lost due to escape of water vapor; also the balance between heat necessary for preheating of stone and decomposition of stone is such that gases are bound to carry off some unusable heat. Taking into account only the heat that a perfect lime kiln could theoretically utilize, then efficiency of this kiln is 81 per cent, and that is very good, indeed, as the part lost by radiation must be close to 10 per cent.

The contrast between what it was, and what it is, is startling. Gas consumption per net ton of lime was reduced from about 6200 cu. ft. to 4100 cu. ft. Capacity was increased from about 18 tons to 50 tons. Lime was greatly improved both by great reduction of core as well as a reduction of the overburned product. Labor cost also was reduced.



Showing how control apparatus and instruments are installed on lime kiln

Burning Spalls

My first experiments were with ¾ to 1½-in. stone in a mixed feed kiln. The kiln was so arranged that a high air blast was possible, also considerable care was taken for proper distribution of the coke charge. Results were very promising. Capacity, considering the size of the kiln was unbelievably high, something like 70 tons from a normal 20-ton kiln. Waste gas temperatures were very low, gas analysis was quite good, and the only faults were caused by the mechanical draw and that was not utilized as it created dust and resulted in over-burned lime and also core in some cases.

Next, it was tried with natural gas in an ordinary kiln equipped with a not fully developed center burner. Results were not a complete success, but they were very promising.

By then it was realized that to properly burn spalls five requirements must be fulfilled.

1) The stone should be properly sized so it will not create an unusual resistance to gas flow.

2) Kiln must be so arranged and equipped that a strong draft can be obtained in the kiln top for drawing the gases through the hot and preheating zones.

3) In addition, air must be also blown into the cooler against the lime resistance and delivered at the gas entrance points of the kiln.

4) Kiln arrangement must be such that gas will be able to distribute itself to all parts of the kiln cross-section.

5) Kiln must be also so arranged that lime can be drawn at will from any section of the shaft.

To violate any of these requirements either means a complete failure or inferior results and, strangely, the first, second and third of these five items are not as important as the last two.

COMPARISON OF MISSOURI AND ARIZONA NATURAL GAS FIRED LIME KILNS

	Missouri	Arizona
Capacity	55	50
Kind of Lime	High Calcium	High Calcium
Size of Stone	Medium to Large	Medium
Kind of Fuel	Av. 6-in.	Av. 4-in. Minus 6-in.
Firing Method	980 B.t.u. Nat. Gas	1120 BTV Nat. Gas
Kind of Draft	Center Burner	Center Burner
	Induced	Induced
Shell Dimensions	Oval	Oval
	14-ft. 2-in x 12-ft. 8-in.	11-ft x 12-ft.
Burning Zone Shaft Dimensions	6-ft. x 10-ft. 8-in.	6-ft. 6-in. x 9-ft.
Cooler Depth	56 sq. ft.	51 sq. ft.
Shaft Height	14 ft.	12-ft.
Storage Zone Height	37-ft. 6-in.	31-ft. 9-in.
Total Height Above Discharge	19-ft. 6-in.	None
Total Height from Floor	66-ft. 0-in.	43-ft. 9-in.
Cooler Space	72-ft.	46-ft. 9-in.
Total Acting Kiln Space	538 cu. ft.	418 cu. ft.
Shaft Space	2758 cu. ft.	2018 cu ft.
Storage Zone Space	2220 cu. ft.	1600 cu. ft.
Total Kiln Space	1950 cu. ft.	None
Foundation Cubical Mass Above Floor	4708 cu. ft.	2048 cu. ft.
Concrete and Masonry	1478 cu. ft.	529 cu ft.
Kiln Cubical Mass Above Foundation		
Masonry Only	5134 cu. ft.	2726 cu. ft.
Total Kiln Mass Concrete		
and Masonry	6612 cu. ft.	3255 cu. ft.
Ratio Kiln Mass to Active Kiln Space		
Not Storage	2.4-1	1.6-1
Kiln Mass Per Ton of Capacity	120 cu. ft.	65 cu. ft.
Lime Per Day—Sq. ft. of Shaft Area	1965 lb.	1960 lb.
Lime Per Day—Cu. ft. of Active Kiln Space	40 lb.	48 lb.
Lime Per Day—Cu. ft. of Total Kiln Space	23.4 lb.	48 lb.
Lime Per Day—Cu. ft. of Kiln Structural Mass	15.5 lb.	30.7 lb.
Cooler (Tons Equivalent Lime)	16 tons	12.5 tons
Shaft Space (Tons Equivalent Lime)	66 tons	48 tons
Weight of Lime in Cooler and Active		
Kiln Space	82 tons	60.5 tons
Time of Travel Through Active Zone	35.8 hrs.	29 hrs.
Gas Consumption Per Ton of Lime	5200 cu. ft.	4120 cu. ft.

Progress in Vertical Lime Kilns

By J. K. BILLINGS*

My Observation runs back to the flat grate wood burning days through the development of the semi-gas-producer to the adoption of the automatic gas producer for lime burning. Many here now have available natural gas as a fuel, and I envy those of you who do. Fuel is and will always be, along with labor and refractories, the major item affecting cost. In order to get the most from them we have had to study many conditions.

In 1919 flat grate production was 10 tons in 24 hours for 50 sq. ft. of kiln shaft area. With the adoption of the semi-producer shortly after this, capacity was increased to about 18 tons, and well can I remember that 500 bu., or 20 tons per day, production was really something to shoot at. All kilns up to this time were on natural draft. Entirely as an experiment, one kiln was covered and an induced draft fan applied. Results were far beyond expectations; production increased to 25 tons immediately, and later, with the elimination of the semi-producers and the substitution of producer gas from an automatic producer, a tonnage of 30 tons of lime for 50 sq. ft. of kiln area was realized.

Although it seemed for many years that the large kilns were built unnecessarily high (107 ft. from foundation to top of skip hoist head frame) and that the storage hoppers were exceedingly large, it has been found that this apparent waste of money in steel and brick was justified, for as tonnage increased it was necessary to diverge from the original form of operation, that of charging only in the day time, to a plan of filling the kilns after each draw through the entire 24 hours of the day. If the kilns had not been built so high, it would have been impossible to obtain the tonnages which Mr. Azbe has mentioned. Not only has the 24-hr. charging method made possible large tonnage, but also a uniform flow of lime through the kiln which maintains not only chemical but physical uniformity.

Most of us have heard the old expression "that it takes lime to make lime." This is more true than ever in the high capacity kilns we now operate; heat must be distributed over a long shaft area. In our case we try to carry at least a full draw of lime ahead in the kiln. In the case of our big kilns this permits a finishing zone in which much core is burned out that otherwise would be left in the lime. Core percentages on these large kilns range from 2 to 3 percent, which we consider nominal.

Induced draft has two very important advantages: first, it increases capacity far beyond any that might be obtainable with natural draft; second, it increases the tons of lime produced per kiln per lining. When induced draft was first tried, and larger capacity was attempted, the refractory problem was even a worse headache than the morning after the night before. However, like headaches, this was overcome and with surprising results. Not only did increased draft cause further heat penetration into the shaft and over a much larger shaft area, it also kept the extreme high temperature in the shaft instead of in the fire arch, and as we all know, the arch is the heart of any kiln structure. Kiln life actually increased almost in proportion to tonnage. In kilns operated on producer gas, draft has an added importance in that gas main pressures as a rule are insufficient to push enough gas into the kiln to maintain high tonnages. It, therefore, becomes the duty of the induced draft fan to pull the necessary gas into the kiln and, with the center burner principle, also the combustion air to support combustion of the gas admitted through the center burner. This is of more importance in the kilns burning large stone than in the spall kiln, as it is quite necessary, due to the density of the mass, to put combustion air into a spall kiln under pressure.

Induced draft fans should be carefully selected and installed, and the method of installation is almost as important as the fan itself. Long sweeping elbows and piping of ample dimensions should always be employed. I know of one instance where the suction in the fan itself was more than 3 in. but the suction in the kiln was zero. This was corrected by providing properly designed piping and closing many leaks in the kiln top. As a result, tonnage was increased, the kiln lining was saved to a great extent, and the material and effort was paid for in a very short time.

Kiln Firing and Drawing

Too much cannot be said for intelligent supervision of kiln firing and drawing. No matter how well a kiln may be designed, the final balance between success or failure of operation lies in the proper trimming at draw time. To avoid excessive core in Ste. Genevieve limestone, it is necessary to operate kilns by the "stick" or "hang up" method. Therefore, a very slight mistake on the part of the kiln puncher may result in rolling the kiln, and in the case of a 75- or 80-ton kiln, the resultant loss is considerable. It is therefore of prime importance to have a foreman present at least the greater number of the draw periods during the 24 hours. This foreman must have an eagle eye not only to see lime hanging to the kiln wall but also to serve as an optical pyrometer in judging the heat of his kiln so that sufficient lime will be drawn to avoid slagging of the refractories before the next draw period. He must also be able to determine whether the lime in the burning zone is hard, medium or soft, as his production needs may require. To enable a visual inspection of a kiln, it is first necessary to see into it at not one but many points, and of course it is just as necessary to be able to get into any and all places in the shaft with a punch rod. Effective punching is never accomplished with short rods. In other words, in our large kilns 20- to 21-ft. punching rods are used, enabling a kiln puncher to reach from one end to the other of these shafts, which are 7 ft. by 12 ft., and to thoroughly clean the upper side arches, the side walls, and the ends. These kilns have 20 poke holes, extending from the operating floor almost to the kiln top, and all of them are used, possibly not at all draw periods, but on occasions we find it necessary to use the upper punch holes when limestone arches in the storage zone. If this were not done religiously every 4-hr. draw period, kiln life would be greatly shortened, and in consequence costs and operating curves would suffer.

Novel Gas Main Cleaning Method

To maintain high tonnage and uniform input of gas in producer gas fired kilns, it is necessary to keep all gas mains clean and free from soot and tar. In our operation, all necks from the gas main and inlets to the kilns, either side fire arches or center burner ports, are blown out with compressed air every 8-hr. shift. This does not delay or retard production, as blow holes are placed in convenient places and the blowing is done with gas pressure on the main. The gas main itself is cleaned once a week in a rather novel manner. It is about 250 ft. in length, and a piece of double strength pipe, mounted on cast iron rollers on the front of which is a nozzle, is pushed through the flue by means of a small steam engine. The air pressure (100 lb.) dislodges the soot and the expended air supports combustion so that after one pass the blower is withdrawn and the main is as clean as a new pin. This operation is necessary only once a week and requires approximately 1½ hours.

As Mr. Azbe has stated, we have operated a vertical spall kiln for some six to eight months. The finished product is very very good.

*From a discussion of Mr. Azbe's paper at the recent annual convention of the National Lime Association.

National Association Meets to Discuss

Industrial Sand Producers' Problems

By NATHAN C. ROCKWOOD

ABOUT 50 representatives of member companies and guests of the National Industrial Sand Association, which now includes some 80-odd percent of all industrial production in the United States, met and held the third annual convention of the association at Zanesville, Ohio, May 11 and 12. Zanesville was selected to honor Edward M. Ayers, president and general manager of the Ayers Mineral Co. there, a pioneer industrial sand producer and a charter member of the association. More about Mr. Ayers will be found on the "News About People" page of this issue.

A. WARSAW, Chicago, Ill., president of the association, reviewed its founding and rapid growth, which has been truly remarkable since prior to NRA the various producers did not even know each other. Much of the work of the association has had to do with freight rates. In this field alone there has been ample justification for coöperative effort. Silicosis problems have also furnished ample reasons for the industry's united front.

Freight Rates

WM. W. COLLIN, JR., Pittsburgh, Penn., counsel for the association in its Interstate Commerce Commission rate cases, reviewed these. He complimented Executive Secretary Ahearn and the members of the traffic committee for their valuable assistance. While impossible to stave off the rate increase, its application was delayed and its amount kept at a minimum.

Dust Control

THEODORE HATCH, associate dust control engineer, Division of Industrial Hygiene, New York State Department of Labor, discussing "Regulations for Dust Control in Foundry and Ceramic Industries," referred to studies made in connection with drafting regulations. As an illustration of preventive measures, he showed lantern slides of conditions in the gold mines of South Africa before and after 1916, when silicosis prevention studies and regulations began. This progress is perhaps the most strikingly illustrated by the fact that it required only nine years' average exposure to acquire silicosis under conditions existing prior to 1916, while 16 years' average exposure under present conditions results in a less severe case.

R. G. Hay, elected president of the National Industrial Sand Association

Commenting on the work done in New York State in drafting a code, Mr. Hatch told of the progress in dust control machinery and equipment. Plans for such are submitted to the division's engineers before installation. The plans are checked and the plant investigated for power requirements. In 1937 some 1700 such proposed installations were examined and 35 percent failed of approval. He said manufacturers of equipment should give guarantees. More of Mr. Hatch's remarks will be published in a later issue.

DR. ROY R. JONES, past assistant surgeon, Division of Air Hygiene, U. S. Public Health Service, speaking on "Medical Phases of Dust Control in the Foundry and Ceramic Industries," said that silica dust is the only mineral dust known to cause a progressive fibrosis of the lungs, and that the harmfulness of the dust is directly proportional to the percentage of free silica it contains. There are other harmful dusts which he described, and he recommended suppression of all dusts in order to play safe. He made quite clear that there is much to be learned by medical men about dust diseases. He concluded by emphasizing the necessity of good housekeeping in the plant control of dust.

E. O. SCHNEIDER, chairman of the association's research committee, outlined the subjects on which research is desirable and said a good start had been made. He suggested that Stanton Walker's request to have his title made "consulting engineer" to the association rather than "director of research" be granted, because Mr. Walker's other duties prevented his giving adequate time to this work.

STANTON WALKER made a brief report, referring his listeners to his report to the board of directors for more details. This latter report is printed elsewhere in this issue. Some progress has been made in following out the program listed there.

Legislation

THEODORE C. WATERS, special counsel for the association in matters relating to "Governmental Regulations Dealing with Occupational Disease Control," discussed this subject at considerable length. His main point was that state control and regulation will steadily increase, with the New York State code as a model. He thought many present objectional features would disappear with more extended experience. At present there is a tendency to put too much emphasis on compensation and not enough on prevention. A digest of his paper will appear in a later issue.

V. P. AHEARN, executive secretary of the association, brought the convention to a close with one of his interesting and enlightening discussions on "The Political Scene in Washington." It was not a very pleasant picture for business men to contemplate.

Officers Elected

RUSSELL G. HAY, Zanesville, Ohio, was elected president; L. M. Hansen, Chicago, vice-president; Ralph T. Stevens, Cape May, N. Y., treasurer. J. M. Strouss, Morgantown, W. Va., and the retiring president A. Warsaw, Chicago, Ill., were added to the board of directors.

Edward M. Ayers and Mr. Ayers and their family entertained the members and guests in their home and at dinner at a famous inn near the city, at his golf club and at his nearby plants. The convention voted unanimously that it was greatly indebted to Mr. Ayers and the members of his family for the most helpful and enjoyable meeting they had ever attended.

(1) Left to right, Geo. A. Thornton, Chicago, Ill.; Alfred J. Miller, New York City; V. P. Ahearn, Washington, D. C.; (2) A. W. Sherwood, Toledo, Ohio, and President A. Warsaw, Chicago, Ill.; (3) Harte Campbell, Thayer, W. Va.; Geo. A. Thornton, Ottawa, Ill.; W. J. Muhlitner, Detroit, Mich.; E. J. Campbell, Thayer, W. Va.; J D. Cronenweth, Detroit, Mich.; (4) Secretary Ahearn and Chairman R. G. Hay; (5) Stanton Walker does his stuff; (6) Chairman Hay; 7) V. P. Ahearn describes Washington political scene; (8) E. O. Schneider, chairman of the research committee, reports; (9) J. S. Cable, Akron, looks up at the photographer; (10) Edward M. Ayers; (11) Geo. P. Allen, Toledo, Ohio; (12) Just an informal discussion

Engineering Problems to Be Solved by

Industrial SAND Research

As Reported by
STANTON WALKER
Director of Engineering, National Industrial Sand Association

A RESEARCH COMMITTEE of the National Industrial Sand Association, consisting of E. O. Schneider, chairman, J. A. Crew, A. N. Farmer, T. C. Matthews, John Putnam and James Whitehead, has drafted a progress report on research which was submitted to the board of directors of the association at the fall meeting in Chicago. The board approved this report and authorized the requests made. Some of the high points of this report, which has been submitted to the membership for discussion and action are, in the words of Stanton Walker:

First, let us consider typical engineering research problems in which the industry is interested without, for the moment, any regard as to whether or not they are of such a nature that they should be undertaken by the Association or are those which are now being studied adequately by other organizations. Among such problems the following may be listed:

I. *Silicosis*
- (a) Cause: i. e., nature and amount of dust; period of exposure; susceptibility of various individuals.

II. *Dust Hazard*
- (a) At Plant.
  - (1) Amount at different points in plant.
  - (2) Period of exposure at different points in plant.
  - (3) Dust control methods.
- (b) At points of use.
  - (1) Amount.
  - (2) Period of exposure.
  - (3) Control methods.
  - (4) Source of dust; i. e., is it caused directly by our product, or are there contributing causes; for example, sand-blast produces dust but a most important source is material adhering to castings.

III. *Foundry Sands*
- (a) Naturally bonded.
  - (1) Significance of American Foundrymen's Association Grain Fineness Number to such characteristics as strength, permeability, etc.
  - (2) Significance of proposed tentative American Foundrymen's Association Grain Distribution Number to such characteristics as strength, permeability, etc.
  - (3) Investigation of significance of other measures of grading.
  - (4) Studies of natural clay binders.
  - (5) Investigation of significance of such factors as strength, permeability, etc.
- (b) Synthetic Sands.
  - (1) Studies similar to those outlined in (a).
- (c) Core Sands.
  - (1) Studies of grading, binders, etc.

IV. *Abrasive and Blast Sands*
- (a) Relation of physical and mineral characteristics to efficiency.
- (b) Comparisons of life of various blast sands and various steel grits.
- (c) Comparisons of dust produced by sand and steel grits under different conditions.

V. *Glass Sands*
- (a) Relation of chemical composition of sand to quality of finished product. (Attention is called to the growing use of glass as a material of construction.)

VI. *Miscellaneous Sands*
- (a) Traction Sands.
- (b) Filter Sands.
- (c) Chemical Sands.

VII. *Investigation of Possibilities for New Markets*

It is not pretended that the preceding outline lists all of the problems; it is meant to be illustrative only. Further, it touches only on engineering research and does not refer to such matters as accident prevention, production and

—*Acme Photo*

Waterproof sand shown at the last Chemical Industries Exhibit in New York City. This exhibition of the uses of waterproof sand was one of the many marvels of modern chemistry and industrial processes on display. The water flows from a small pipe at the right through a series of curves in the waterproof sand to an untreated portion of sand where it is absorbed

price trends, employer-employe relations, market trends, etc., which have been discussed as desirable fields of research. A consideration of the outline makes several facts obvious. First, to undertake a reasonably comprehensive study of all of them would require an appropriation far beyond any possibilities now or in the near future; second, many of the problems are of as much interest to other industries as to our own and our industry should not be expected to undertake them alone; and third, no matter how well we might be financed within reason, many of the problems are of such a nature that they can better be undertaken by agencies other than our own.

Let us discuss some of the more important of them from the point of view just outlined:

Silicosis. A study of the cause and effect of silicosis is of widespread interest and extends far beyond the limited bounds of our industry. We should, and do, support and co-operate in its study but the principal research agency should be one other than our own. The Air Hygiene Foundation seems to be the logical focal point, with its efforts supported and supplemented by the various interested groups — industries, public health services, insurance companies and the like.

Dust Hazard. Problems of dust hazard are, of course, definitely related to silicosis, and, to some degree, the comments with respect to silicosis made above apply here. However, here is an opportunity for the several interested groups, in which our own is included, to supplement the broader activities of such organizations as the Air Hygiene Foundation. The industry should learn for itself answers to such questions as are proposed under Section II (a) of the outline and the industry should cooperate vigorously with the users of its products to develop answers to the subjects listed in Section II (b). While some groups of the industrial sand industry are more interested in the solution of such problems than others, it should receive general support.

The Association is a member of the Air Hygiene Foundation and its Executive Secretary is a member of the Board of Trustees of that organization. Also, the Executive Secretary is Chairman of the Committee on Economic, Legal and Insurance Phases of the Silicosis Problem of the National Silicosis Conference, an organization sponsored by the U. S. Department of Labor. Through these contacts it is felt that the point of view of the industry is being as effectively presented as is practicable at the present time.

A more complete study of this problem could be made, of course, by the employment of an experienced and intelligent field man who could develop information along the lines outlined in Section II. However, it does not seem that the Association is now in a position to employ such a field man and, as a step in the right direction, we suggest that the committee be authorized to select an appropriate testing laboratory, the services of which would be made available to individual member companies at cost, for the conduct of dust counts in their plants. With such a service available, it seems entirely reasonable that, through the voluntary efforts of individual companies, a considerable amount of valuable information might in time be developed.

Foundry Sands. Our foundry sands are being sold on specifications developed by the consumer. Some of the requirements appear to be essential and some appear to be unduly onerous. While some individual companies are well-informed, the industry, as a group, is not in a position to discuss the merits of the various requirements without further research. It seems evident, however, that the Association is not now in a position to start an investigation of foundry sands but it can undoubtedly develop some valuable information by keeping in touch with the research activities of individual member companies.

The director of engineering of the Association and representatives of certain member companies, through their membership on the Foundry Sand Research Committee of the American Foundrymen's Association, are in close touch with the work of that association, the organization having the greatest influence on purchase specifications for foundry sands. We believe that the principal efforts of our association with respect to foundry sands at the present time should be devoted to co-operation with the American Foundrymen's Association and the study of trends of investigations being conducted on the physical characteristics of foundry sands by producers and users of the product. In that way the viewpoint of the industry can be presented. In making this recommendation we, by no means, decry the desirability of our association's conducting investigations on foundry sands, but we do not believe that conditions are such as to make logical the recommendation that such work be undertaken immediately.

Abrasive and Blast Sands. Studies of this problem are of outstanding interest to a group of our association. Work on it falls in two categories—field and laboratory — and any concerted efforts would require the employment of additional personnel. We recommend that, for the time being, the activities of the Association be restricted to keeping the membership informed on developments and co-operating in every way in the promotion of good housekeeping in the plants of the producers and users of the products.

From this report it will be observed that the Research Committee is reconciled to the thought that it is not immediately practicable to start a formal research program. We feel that the industry is not yet quite ready to assume the responsibility for such a program. Nevertheless, we feel that the Research Committe has an important function to perform. Through questionnaires and through specially appointed sub-committees it should develop what information is now available on the several problems, for use in presenting the viewpoint of the industry in the various fields. From time to time members of the Association will receive questionnaires and it is urged that replies be made to them whether or not there is anything of a tangible nature to report.

The Research Committee was accorded authority to:

(1) Appoint certain special sub-committees to study specific problems such as dust hazard, molding sands, etc.

(2) Develop a standard method for chemical analysis of silica sands.

(3) Arrange with a laboratory or laboratories to be the official agent of the Association in the conduct of chemical analyses of silica sands and in the conduct of dust counts at points of production or use; such work to be done at cost on request of individual member companies.

(4) Arrange either through a "Clipping Bureau" or through increased library work at association headquarters to keep a record of all current literature of interest to the industry.

AN ENORMOUS GRAPHITE ore deposit is reported to have been found in California in Green Canyon near Big Bear. Homer M. Derr, Santa Ana geologist, after making a survey, said: "There is an exposure of graphite ore on the surface extending along the line of fault for a distance of 1600 ft. and 300 ft. wide, shut off by a rhyolite dike at the other. Judging from the type of formation, we have the right to assume that this deposit will extend to a depth of at least 2000 ft. Upon that basis of assumption, I calculate 960,000,000 cu. ft., or 70 million tons of ore, which will average better than 10 percent graphite."

NORTON BROTHERS SLATE CO., Granville, N. Y., agreed to keep 100 slate workers employed during the anticipated three-month slack period at a wage rate 5 cents under the usual scale and for 32 hours per week.

Detecting Free Lime and Magnesia In Portland Cement

AUTOCLAVE Tests and the MICROSCOPE

By L. S. BROWN and M. A. SWAYZE*

EXCESSIVE EXPANSION which has developed in certain concrete roads and structures constructed in the last decade is of very serious concern to the whole portland cement industry. While cements containing small amounts of magnesia (1-1½ percent) have been relatively free from this action, some carrying only 3 percent or slightly more have been found to cause trouble. The fact that these cements have very generally passed the present A.S.T.M. soundness test when shipped makes it almost self-evident that a more severe test is necessary if the present difficulties are to be avoided.

The recommendation of the Portland Cement Asosciation laboratories for the adoption of the autoclave test has already been unanimously accepted by the cement industry. However, the test has not yet been fully correlated with service performance. The difficulties in the way have been large—no samples of cement exist representing bad concrete, and we cannot wait 5 or 10 years to see what will happen to present products when they are put into roads.

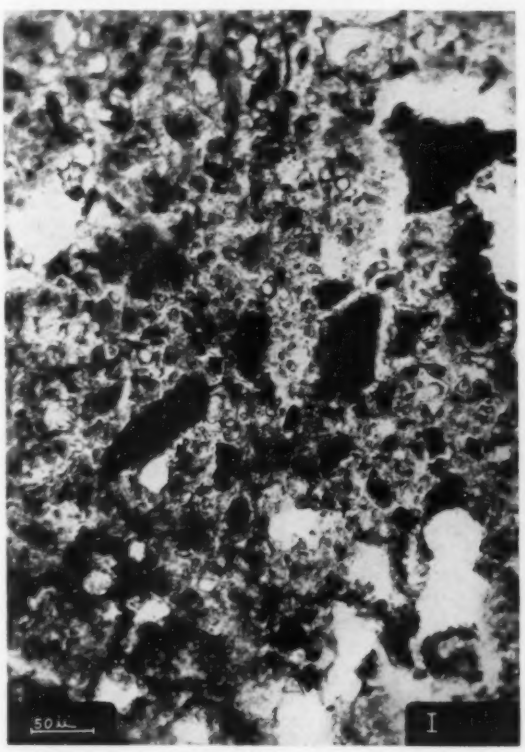
The Lone Star Research Laboratory determined to attack this problem in two ways, beginning with the conceded fact that the expansion is the result of delayed hydration of free lime and crystalline magnesia. One attack was with the microscope. The character of occurrence of free lime and magnesia in cement clinker was already known to us; it remained to determine the action of 70 deg. F. water, of the present steam test, and of the autoclave on these materials.

Free lime and magnesia, as they normally are found in portland cement, take up water with the formation of the hydroxides $Ca(OH)_2$ and $Mg(OH)_2$. The alteration at ordinary temperatures is slow for lime and very much slower for magnesia. The alteration is attended with a volume increase of 97 percent for lime and 118 per cent for magnesia. They are, therefore, substances of potential disruption as constituents of portland cement, although apparently it is possible for them to be present in harmless forms.

Three Forms of Free Lime

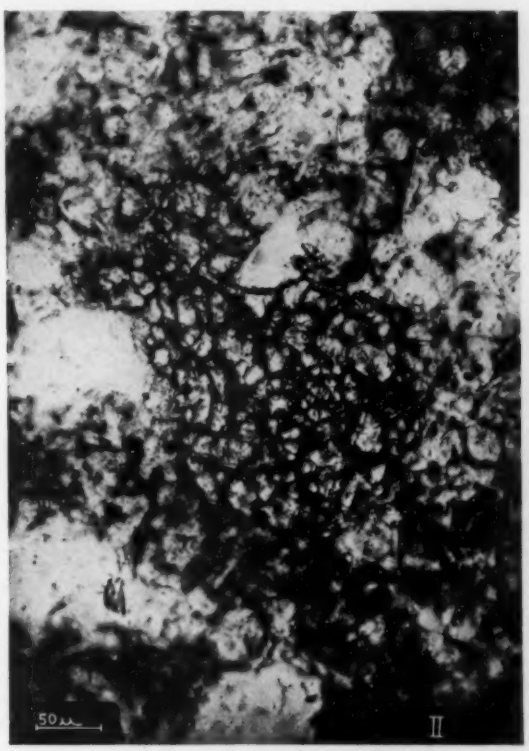
There are three forms of free lime encountered in portland cement: (a) light-burned (quicklime), (b) hard-burned, and (c) air-slaked. Light-burned lime is shown in Plate I as gray to dark particles, highly irregular both in shape and size. The lime has been burned slightly more than enough to drive off

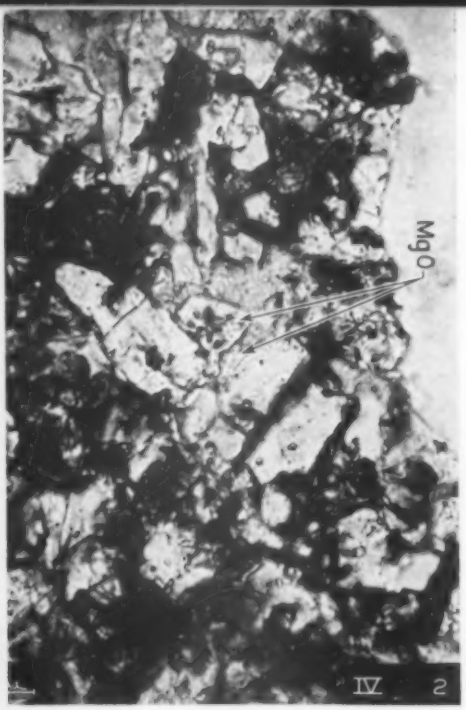
* Petrographer and Chief Research Engineer, respectively, Lone Star Cement Corp., Hudson, N. Y.



Above: Plate I. Light burned lime in underburned clinker. Gray to dark particles irregular in size and shape are light burned lime, which show up dark because of high and fine porosity

Below: Plate II. Hard burned lime in clinker. Large irregular grain in center of photograph, about 200 microns in diameter. Grain is outlined and traversed by heavy dark lines caused by high refractive index





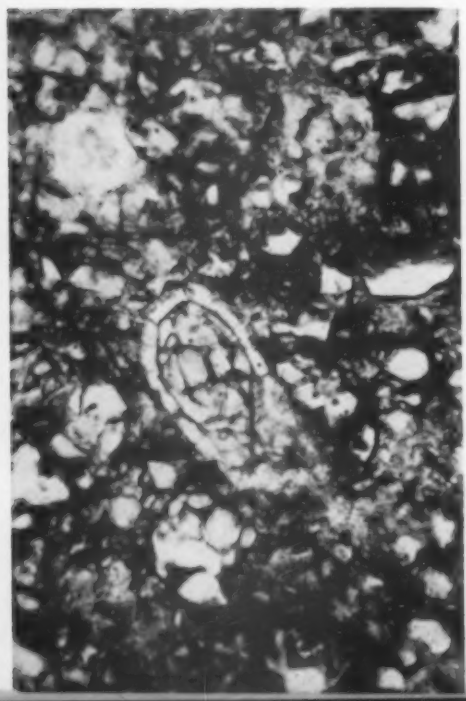
Above: Plate IV. Hard burned magnesia in commercial clinker. Two crystals in center of photograph indicated by arrows

•

Right: Plate III. Hard burned lime partially air-slaked: new form of $Ca(OH)_2$. (a) View with plane transmitted light (b) showing birefringence with crossed nicols

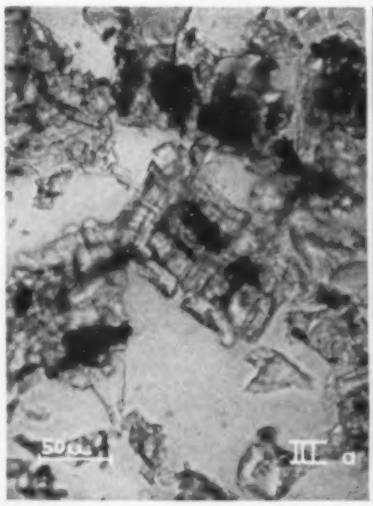
•

Below: Plate V. Free lime in neat briquette after 24 hours in mold, shown in center of photograph. Grain has hydration border about 5 microns deep



the CO_2, leaving the CaO in a very finely porous form. This form is found occasionally in small amounts in under-burned clinker. Because of its highly porous character, i.e., a high ratio of surface to volume, it hydrates very rapidly, and is harmless to concrete in that respect. Plate I is a section of under-burned clinker, magnified 200 diameters.

A grain of hard-burned lime is shown in Plate II, approximately 0.2 mm. across as seen in a commercial clinker. With continued heating after loss of CO_2, the finely porous lime recrystallizes into dense compact, hard particles, which, because of a low ratio of surface to volume, hydrate slowly. These grains are residuals of the larger particles in the raw mix; they occur in a wide variety of sizes, up to 1.5 mm. across. The larger particles in the clinker are broken down on grinding to cement, so that fragments of free lime alone may be formed. The smaller sizes have an increasing liability to be enclosed within cement grains, thus being more or less completely protected from early attack by moisture. Hard-burned lime is the most dangerous form.



Air-slaked, hard-burned lime is found in all clinkers or cements originally containing free lime that have been held in open storage for more than a few hours. The slaking is a change with marked expansion, the resulting fragments appearing somewhat like grains of popped corn, as seen in Plate III a. Cubical cores of lime yet unchanged may be seen at the center. With this expansion the free lime is rendered harmless.

This air-slaked material is a heretofore unidentified form of calcium hydroxide. Its optical properties differ from normal crystalline $Ca(OH)_2$ in that it is uniaxial but positive instead of negative, with indices omega between 1.54 and 1.55, epsilon between 1.55 and 1.56. This seems to be the "unknown" mineral named Epezit by the German writers Guttmann and Gille. It is easily soluble in alcohol-glycerine solvent. Plate III b shows the birefringence of the mineral with crossed nicols. Plate III c shows the mineral as found in a commercial clinker which had been broken down by expansion of the free lime to this new form.

Effect of Chilling Clinker On Magnesia

Magnesium carbonate, like lime carbonate, loses its CO_2 at quite low temperature, yielding a finely porous product that hydrates rapidly. Such light-burned material, however, has not been identified in cements or cement clinker. Like lime, it also recrystallizes into dense, compact units at rotary kiln temperatures, but amounts present in commercial mixes, up to 1.25-1.50 percent, are taken into solution in the liquid formed at the clinkering temperature. Its harmful expansion seems to be inhibited by chilling the clinker so that the magnesia is retained in solution in the glass. On the other hand, if the clinker is cooled slowly, thus permitted to crystallize more or less completely, the magnesia is thrown out of the solution. It has a tendency to form octahedra, but usually it appears as quite irregular interstitial grains. One of the largest grains we have observed in commercial clinker is shown in the center of Plate IV. It is roughly rhombic in shape, and measures about 20 microns across.

To study the rates of hydration under different curing conditions, specimens of neat pastes were made up to normal consistency. A commercial cement carrying 2.25 percent free lime was used to follow the hydration of hard-burned lime. Magnesia, as it usually occurs in clinker, is so fine-grained, and so near in refractive index to that of

the silicates, that it is rather difficult to observe. Accordingly, a cement low both in free lime and magnesia was chosen, to which 2 percent of powdered hard-burned magnesia was added. The set cements in each case were examined microscopically in thin section, with observations as follows:

Hydration Studies

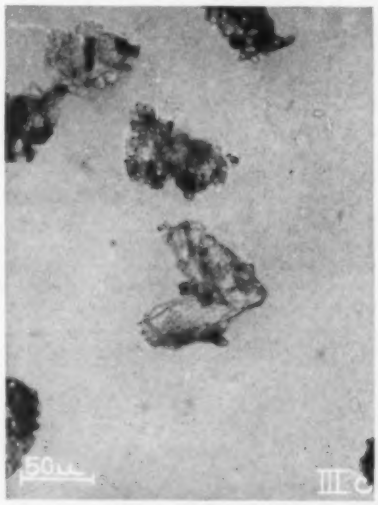
(a) Cured 24 hours in the molds.

FREE LIME. Plate V. Grain in center shows hydration border about 5 microns wide. From this it is seen that a grain of free lime about 4 or 5 microns in dimension represents about the maximum size that can be completely hydrated in 70 deg. water in 24 hours. This refers only to grains exposed on all sides; otherwise, hydration will be hindered.

MAGNESIA. Plate VI. Grain in center shows no trace of hydration with 24 hours of moist curing.

(b) 24 hours in mold, followed by A.S.T.M. steam test.

FREE LIME. Center Plate VII a. Hydrated border around grain in center is about 20 microns wide. Hence, maximum size of a grain of lime that will be completely hydrated with this treatment will be approximately 20 microns under the most favorable conditions. In Plate VII b there is shown a large cement particle enclosing two rounded grains of free lime, thus protected as previously described. They have survived the boil test without change.



MAGNESIA. Plate VIII. Large grain of magnesia in center shows no trace of alteration in steam test.

(c) 24 hours in mold followed by autoclave treatment.

FREE LIME. Plate IX. The large dark grain below the center is a cement particle, which originally carried several free lime grains (toward the upper side). Autoclaving has completely hydrated the lime, which now shows as large clear areas in the photograph. Expansion on hydration is shown by the prominent radial cracks through the cement particle.

MAGNESIA. Plate X. A large grain of magnesia just below the center is partly hydrated. The width of the hydrated zone is quite variable but will average around 20 microns. Thus the largest grain of magnesia that autoclave treatment will hydrate is about 20 microns; since the normal size of magnesia grains in cement does not exceed 20 microns, it is evident that autoclave treatment will be around 100 percent effective. Notice in the photograph the large cracks extending out from the magnesia through the paste.

Summary

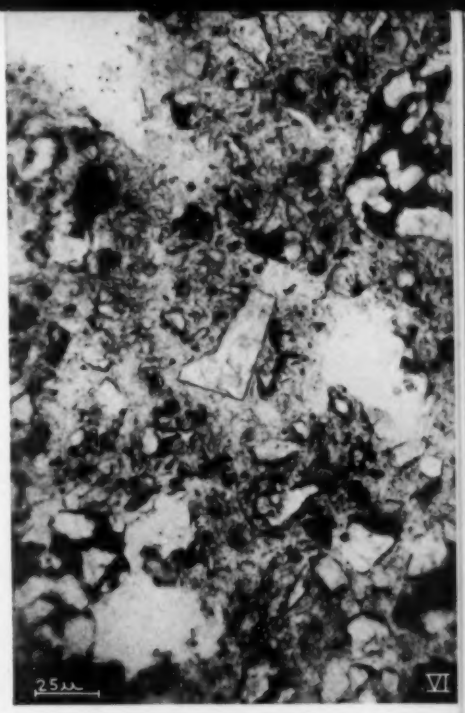
In summary, grains of free lime and magnesia will hydrate at the maximum rate, for any condition of curing, if they are single, individual particles completely exposed. In general the grains found in cement will be more or less enclosed within particles of clinker, and their hydration will thus be delayed. For free lime grains entirely exposed, the maximum size that will be completely hydrated in the boil test is approximately 20 microns. Grains exceeding 20 microns are not uncommon in commercial products. The maximum size that can be hydrated in the autoclave treatment has not been determined; we have been unable to find any unhydrated lime in autoclaved specimens.

Magnesia appears to be unaffected by the boil test. In the autoclave it is rapidly attacked, with size limits for separate grains in vicinity of 20 microns. In general the grains of magnesia found in cements will be considerably under 20 microns.

Moreover, the autoclave test is much more effective than the boil test in hydrating cement minerals, thus diminishing the likelihood that enclosed lime or magnesia grains can survive the treatment unaffected. It has been shown that it is possible for free lime to remain unhydrated through the boil test, and magnesia is quite untouched; on the other hand, the autoclave treatment is found to hydrate nearly, if not quite completely free lime and magnesia as they usually occur in portland cement.

Autoclave Test Most Reliable

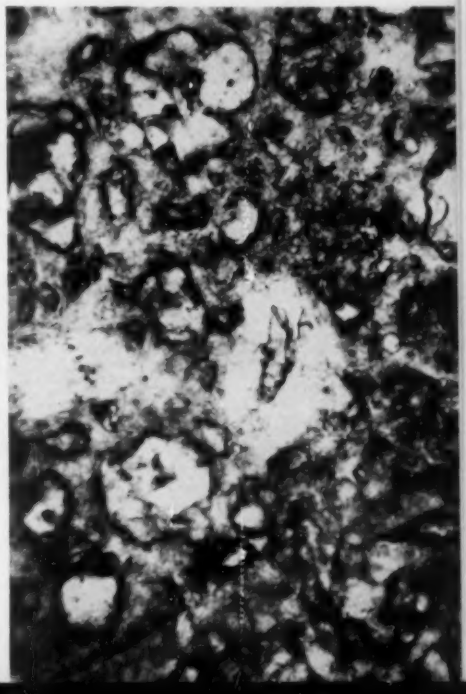
With the knowledge gained from the microscopic examinations, we could now rely on the autoclave to produce complete hydration of the free lime, and also the full expansion of magnesia grains of the size which occur in commercial cements, and could, therefore, utilize this apparatus to indicate when expansions would likely occur over a period of years in normally cured mortar and concrete specimens.

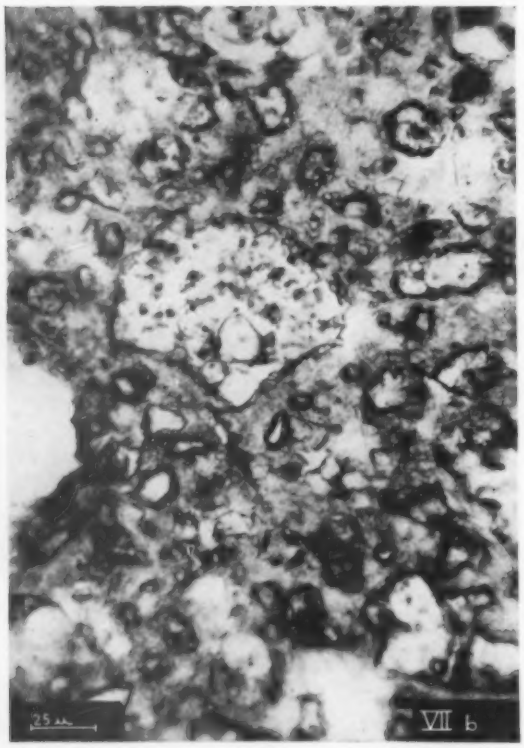


Above: Plate VI. Crystalline magnesia in neat briquette after 24 hours in mold. No trace of attack by water

Left: Plate III. Hard burned lime partially air-slaked: new form of $Ca(OH)_2$. (c) Same mineral found in commercial clinker after air-slaking

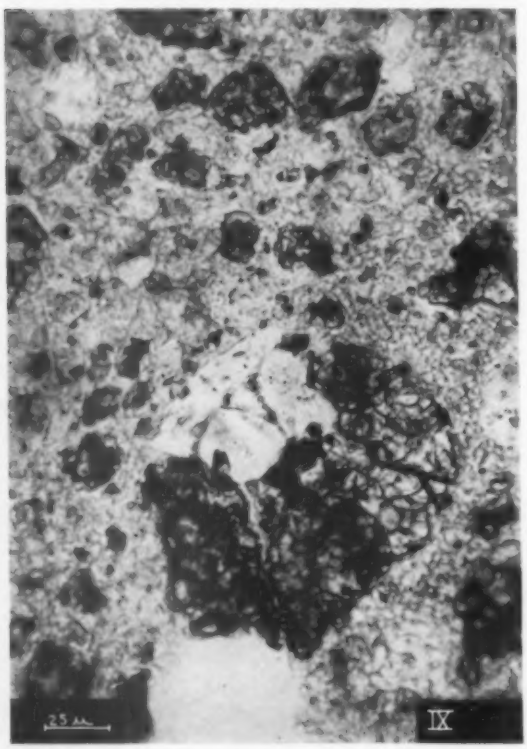
Below: Plate VII. (a) Free lime in neat briquette after A.S.T.M. steam test, center of photograph. Grain has hydration border about 20 microns deep





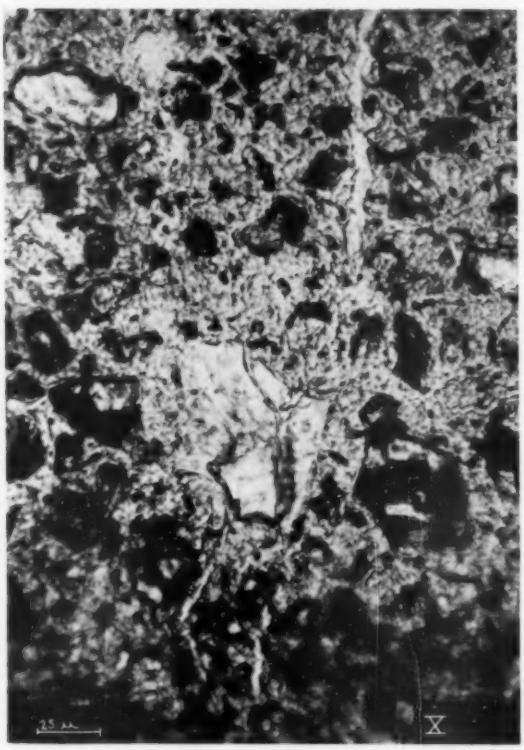
Above: Plate VII. (b) Free lime in neat briquette after steam test, center of photograph. Two rounded free lime grains inside of cement particle. Thus protected, they have not been reached or attacked by moisture except along edge of grain where slightly exposed

Below: Plate IX. Free lime in neat briquette after autoclave treatment. Grains at center, originally imbedded in large dark colored cement particle, completely hydrated. Note expansion shown by radial cracks in cement grain



Above: Plate VIII. Crystalline magnesia in neat briquette after A.S.T.M. steam test, center of photograph. Grain shows no trace of attack by moisture

Below: Plate X. Crystalline magnesia in neat briquette after autoclave treatment, just below center of photograph. Hydration border averages about 20 microns deep. Expansion shown by wide cracks extending through paste. Unhydrated magnesia is shown at center of grain



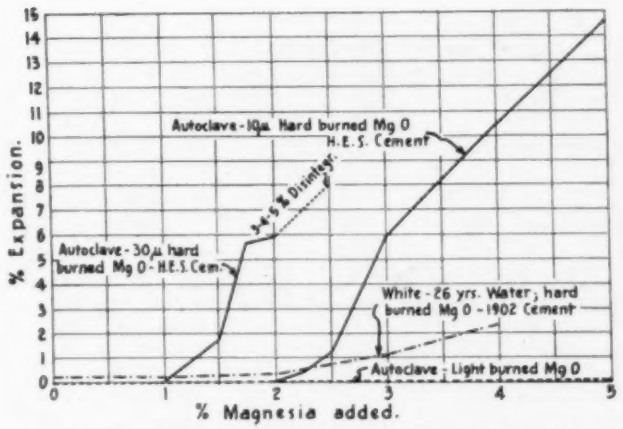


Fig. I. - Comparison Autoclave and Water Expansion.

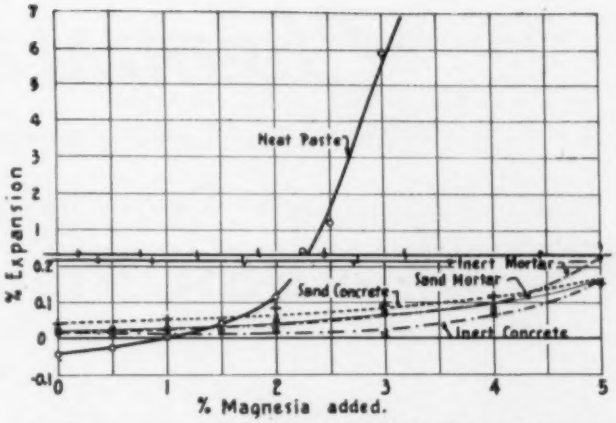


Fig. II - Comparison Autoclave Expansion - Neat, Mortar and Concrete.

Our first results are given in Fig. 1, which shows expansions caused by varying the form and percentages of magnesia in neat pastes compared with the expansion after 26 years of hydration under water as found by Prof. A. H. White and reported in A.S.T.M. *Proceedings*, Vol. 28, Part 2, p. 398.

While we do not have complete information on the materials used by Prof. White, we must assume that the cement was representative of the average quality for the year 1902. Such a product would have much less physical resistance to expansive forces than modern cements. His magnesia was stated to be "finely ground and hard burned." Again we must put a 1902 interpretation on fineness.

For the materials for this test we chose a high early strength cement containing 1.4 percent MgO which is volume constant in the autoclave, with the idea of obtaining the maximum physical resistance against the expansion of magnesia additions. The magnesia was a pure product prepared by the Norton Co.—completely crystalline, and all passing the 100-mesh sieve. The average grain size was approximately 30 microns, and was probably about equal to the material used in White's tests. For our tests on fine magnesia, part of this original material was reground and then subjected to air separation. The average particle size of the fine material was about 10 microns, which compares closely with the grain size found in commercial cement.

In Fig. 1, White's tests show normal water expansion over 26 years for neat cement pastes with 2 percent of added magnesia. Even with the more resistant modern high early strength cement, the autoclave produced excessive expansion with as little as 1.50 percent of magnesia 30 microns in size, and with 2½ percent of very finely ground magnesia.

No expansion was found for mixtures up to 5 percent of light-burned magnesia. Presumably this material hydrated before set had taken place, and, therefore, caused no damage.

Effect of Fine Grinding

Two interesting conclusions can be drawn from this figure. First, the autoclave will produce high expansions in cements containing amounts of crystalline magnesia which would be undetected by long time water storage. Second, fine grinding of the magnesia reduces its expansive effect by decreasing the strong local effect of the larger grains. This has considerable commercial significance. Where in our tests the cement fineness remained constant, in commercial production the cement and magnesia fineness will both increase with finer grinding. The smaller grains of magnesia will not only have less expansive effect, but the finer cement itself will have greater resistance to the stresses set up.

Our second series of tests are given in Fig. 2. These consist of a comparison of autoclave expansions on neat pastes, 1:2 mortars and 1:1½:2½ concrete, using the same cement and fine magnesia as in the previous tests. Two parallel tests were run: one with a siliceous sand and pea gravel for the concrete; the other with inert fine and coarse alumina aggregate. No reaction could be noted between cement and the inert material with the microscope. Net water contents corresponded to water ratios by volume of 0.35 for neat pastes, 0.60 for the mortars and 0.75 for the concretes.

In these tests the neat paste with 2½ percent magnesia expanded over 1 percent and further additions caused very high volume increases. The siliceous aggregates gave gradually rising values with each addition, but no material expansion or break in the curves is apparent until 4 percent of magnesia is added.

The inert aggregate produced smaller initial expansions in both mortar and concrete, and the increases were also less up to 4 percent addition, after which the rate of increase up to 5 percent was more rapid than for the siliceous aggregate.

These tests indicate that in the dense, hard neat paste there is less room for either free lime or magnesia grains to expand in a harmless manner than in the mortars and concretes, and, therefore, the tendency for excessive expansion will be detected by the autoclave test long before the amounts of magnesia or free lime reach limits dangerous to the life of mortar or concrete in the field.

The conclusions we have drawn from our investigations are:

First, that the present A.S.T.M. steam test is entirely inadequate as an indicator of the tendency toward delayed expansion. Not only is crystalline magnesia completely unaffected by the steam treatment, but the larger free lime grains are incompletely attacked by the test. Small grains of lime inside of clinker particles remain essentially unchanged.

Second, the 5-hour autoclave test at 420 deg. F. as adopted by the cement industry furnishes a reliable index for this type of unsoundness. In only the coarsest of cement particles can lime and crystalline magnesia escape the complete action of the high pressure treatment.

AMERICAN SAND AND GRAVEL CO., Hattiesburg, Miss., has purchased the plant equipment of the Myles Gravel Co., Myles, Miss., consisting of sand and gravel pumps, Diesel engine drives and dredge boats. It is reported that one of the plants purchased has been placed in operation near Utica, Miss.

Chemists' Corner

Hard-Burned Lime Rather than Hard-Burned Magnesia Causes

EXPANSION In AUTOCLAVE?

Discussion by
H. H. VAUGHAN

H. H. VAUGHAN, president of the Canadian Foreign Investment Corp., which owns a controlling interest in the Companhia Brasileira de Cimento Portland, S. A., Sao Paulo, Brazil, has written and published a 23-pp. booklet entitled "Magnesia and the Autoclave Test," a copy of which can be obtained by addressing him at 1111 Beaver Hall Hill, Montreal, Que. Mr. Vaughan attended the spring meeting of the Portland Cement Association in New York City in 1937 and heard the discussion of the autoclave test, which had been adopted by the Association as a control test. He is a civil engineer, a member of the Engineering Institute of Canada, who has given much of his time to manufacturing problems of the cement industry.

Mr. Vaughan takes issue with the conclusions drawn by H. F. Gonnerman, manager of the research laboratory of the Portland Cement Association as a result of the autoclave test. The White tests referred to are those made by Dr. A. H. White, professor of chemical engineering, University of Michigan, several years ago. From an extensive survey of the literature on portland cement Mr. Vaughan draws the following conclusions:

Summary of Conclusions

"Both expansion tests and microscopical examinations of cements to which hard-burned magnesia has been added are misleading in determining the action of magnesia present in the mix. There is no experimental evidence supporting the theory of abnormal delayed expansion caused by magnesia. The White tests, the P.C.A. expansion tests and those quoted on high magnesia cements agree quantitatively on the expansion that actually occurs, and show a small but definitive increase in water storage while air storage tests submitted show a practically equal decrease in air storage. That no trouble develops from expansion or other effect is supported by records of years of experience in every class of service with several million barrels of cement having a magnesia content higher than that allowed by U. S. Specifications.

"The reversal in air storage from contraction to expansion which has been shown to lead to disintegration after several years is caused by delayed expansion due to hard-burned lime and is probably the cause of the majority of failures that can be definitely allocated to the quality of the cement.

"The autoclave test determines the presence of free lime that remains unhydrated after the preparation of the specimen. The explosive nature of the rapid hydration by high pressure, high temperature steam is more noticeable than the slower expansion in the Le Chatelier test but with regard to the determination of objectionable amounts the results are comparative. In both tests information is obtained that cannot be determined by chemical analysis.

"The autoclave test is of no value in determining the magnesia content of a cement as that is obtained from the chemical analysis. It is exceedingly sensitive to variations in the burning temperature or rate of cooling of cements containing over 2 percent magnesia, but does not distinguish between expansion caused by such variations or that caused by the presence of hard-burned lime, neither does it determine whether such variations have existed in the case of cements with low magnesia contents. These objections do not apply to the Le Chatelier test which is not affected by the magnesia. Apparently the effect of these variations if deleterious is reflected in the physical properties of the cement.

"Provided free lime content is low, a low magnesia cement will apparently pass the autoclave test irrespective of burning conditions, rate of cooling or proportion of tricalcium aluminate. For a high magnesia cement (plus 2 percent or 3 percent) to pass this test the burning temperature must be high and if results in P.C.A. Paper No. 33 by Lerch and Taylor, are correct, higher than that which develops the best physical results, the clinker must be cooled below a maximum rate, the latter two conditions both affecting the economy of operation, in fuel consumption, life of lining and cost of grinding, and the proportion of the tricalcium aluminate must be kept down which in many cases can only be accomplished by an increase in the iron content irrespective of whether this is a desirable modification in the quality of the cement. These requirements are not imposed to improve the quality of the cement but to enable it to pass a test in which it is submitted to conditions which it can never encounter in service and which have yet to be shown to determine the results the cement will give in use.

"One point appears definite, namely that high autoclave expansion caused by the above kiln and cooler variations indicates that the magnesia is exposed to more rapid hydration. It cannot be converted from the dense-burned to the hard-burned form by slow cooling or low burning temperature. Exposure to more rapid hydration must result in less unhydrated magnesia after any given time and the inference that autoclave expansion due to this cause is an indication that delayed expansion will occur is entirely unjustified.

"Low expansion in the autoclave tests determines that, as far as unhydrated lime is concerned, the cement is of satisfactory quality; so does the Le Chatelier test. High expansion in the autoclave test does not determine that the cement is of unsatisfactory quality; in the Le Chatelier test it does. It would certainly have appeared more reasonable when condemning the pat test as unsatisfactory to have considered the possibilities of a well established test that has proven reliable and satisfactory for years than to have adopted an extreme type of test without thoroughly investigating its action under all conditions. The present limits allowed in the Le Chatelier test are perhaps liberal but even as they are, it would prove sound policy to ascertain whether any cement that has passed this test has ever given

trouble in service before resorting to a test in which the cause of its indications are so indeterminate.

"That the autoclave test is valuable for plant control may be freely admitted and if it were introduced for a particular quality of cement there could be no possible objection. If applied to all cements made and especially to cements when freshly ground, undoubtedly batches will be produced which do not comply with its requirements and the question must arise as to what is to be done with that cement."

In support of his contention that it is hard-burned lime rather than hard-burned magnesia that causes expansion in the autoclave, Mr. Vaughan gives the following argument:

Expansion Caused by Lime

"With regard to lime the situation while similar presents certain differences. It appears to occur in the amorphous form which hydrates rapidly and may be termed quick lime, and in the crystalline or hard-burned form which hydrates slowly. The action of this constituent is clearly described by Lea and Desch.[1] After referring to the amorphous form which apparently can exist in cement, they discuss the action of the crystalline form which is formed at 1400 deg. C., the crystals continually increasing in size with time. A large crystal placed in water dissolves very slowly at the surface. Finely powdered crystals which at first appear to be inert with water in a few minutes hydrated with explosive violence. They remark that the decrease in reactivity of the lime with increasing temperature of formation (i.e., with larger crystallization) is due less to molecular change than to shrinkage and reduction of surface. They further remark that the expansion of defective cement is due to the slow hydration of certain of its constituents. That the expansion of the CaO is only apparent, as the volume of the slaked lime is actually less than the volumes of quick lime and the water from which it is formed, but the mechanical outward thrust is very great. (This is a difficult sentence to interpret.) They further refer to the hydration of quick lime as being completed before setting begins and harmless, and state that cements prepared from mixes of too high lime content or insufficiently well-burned contain CaO in the dead-burned (or crystalline) form which only becomes hydrated after long exposure in water and then exhibits expansion in a marked degree.

"There appear to be two causes that permit the formation of hard-burned lime, insufficient burning and defective mixing (with or without sufficiently fine grinding of the mix.) With regard to the first, Kuhl's statement that free lime cannot exist in cement clinker would appear to refer to a condition when the clinker is finally heated to 1500 deg. C. and the formation of the C_3S is completed. At lower temperatures, plus 1260 deg., at which formation of C_3S commences while the C_2S is formed and has taken up all the lime it can, the remaining lime is not combined and does not enter into combination to form C_3S until higher temperatures are reached and sufficient time has elapsed for the reaction to occur. If, therefore, burning is not sufficiently complete there is every opportunity for the formation of hard-burned lime.

"With raw mix, coarsely ground or badly mixed, there is another opportunity for hard-burned free lime as the constituents will not enter into sufficiently intimate contact to enable the various reactions to occur. In some cases of large sticky clinker calcium carbonates have been detected showing that while the exothermic action may have occurred in the surface, the central portion of the mass has not been raised to sufficiently high temperature to complete the calcination.

Lime in Two Forms

"While it is stated above that lime only exists in two forms, quick lime which hydrates before setting begins and hard-burned lime which hydrates slowly, the latter must evidently occur in a finely divided form to account for expansion in either the pat or the Le Chatelier tests. While the Emley test for total free lime may not be accurate and includes quick lime, hydrated lime and hard-burned lime in one total, it is practically certain that hard-burned lime does not occur when no quick lime is present. The Le Chatelier test may show a low expansion with high free lime, i.e., when mostly quick lime, but the Le Chatelier expansion is never high with low total free lime. High expansion in the Le Chatelier test undoubtedly indicates a danger of defective results in service. These rarely develop in water storage tests, as in most cases, due to the continued presence of water, the hydration is gradually completed. Conditions in service more closely resemble those in ordinary or humid air storage, and expansion of the hard-burned lime is undoubtedly the cause of the type of abnormal expansion shown by R. N. Young. This is accompanied by a definite reversal in the expansion curves in dry and humid air, and a similar reversal is shown in the White test in which finely ground calcite was added to the cement. This danger signal was exposed years ago but apparently ignored by all except Mr. Young. Possibly White's remark that "Magnesia does not give trouble through expansion if the cement products are kept continuously in air" accounts for the preference for water storage which shows very little, in place of air storage which can show a great deal. This delayed expansion is entirely different in form to any expansion caused by magnesia which in any event would be shown in water storage and not in air storage tests. Fine particles of hard-burned lime are the cause of high expansion and possible deterioration during the first month or a year in water storage and very possibly an important factor if not the main cause of the deterioration shown in Young's paper.[2] It seems unreasonable that the large grains ascribed to lumps and not entering the melt should occur in such quantities or regularity as to exert an important influence in service. For a content of 1 percent any size particles will be spaced on the average 10 diameters apart and this is certainly not the case with these large grains. It is more likely that the finer particles of hard-burned lime which do not hydrate in the preparation of the test piece but will hydrate 20 microns deep in the steam test, will hydrate far more slowly in air storage and give rise to the delayed expansion. It is significant that added hard-burned magnesia which will hydrate 20 microns in the autoclave, gives rise to delayed expansion between 3 to 8 years in water storage and is unaffected in air storage, while hard-burned lime which is hydrated 20 microns in the steam test gives rise to delayed expansion in 6 months to 4 or 5 years in air storage. The two actions appear reasonably similar.

"It may be noted that in each of these cements the MgO content is low, 2.1 percent to 3.4 percent, and the delayed expansion is undoubtedly due to hard-burned lime. The cement containing 3.0 percent free lime and 5.2 percent MgO, while wet storage expansion is high, there is no indication of any deterioration in service or any reversal in air storage curves."

---

[1] Chemistry of Cement and Concrete, London, England, 1935.

[2] R. N. Young, **Journal of the American Concrete Institute**, Vol. 9 No. 1, Sept.-Oct., 1937.

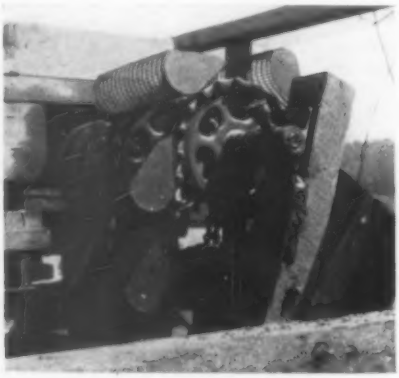
Erratum

IN THE LIST OF WINNERS of the cement industry safety rewards on page 53 of the May issue of ROCK PRODUCTS, the Manheim, W. Va., plant of the Alpha Portland Cement Co., was credited with winning of trophies in the years 1928, 1930, 1933, and 1937. Superintendent W. L. Matthes advises that this plant also was the winner of a reward in the year 1936.

HINTS AND HELPS FOR SUPERINTENDENTS

Buckets of Screen Wire

CARL LOTZ SAND & GRAVEL CO., Wausau, Wis., has been using an unusual bucket elevator arrangement for scalping out 1/8-in. to 3/8-in. gravel when making sand.



Screen wire bucket arrangement for removing gravel in making sand

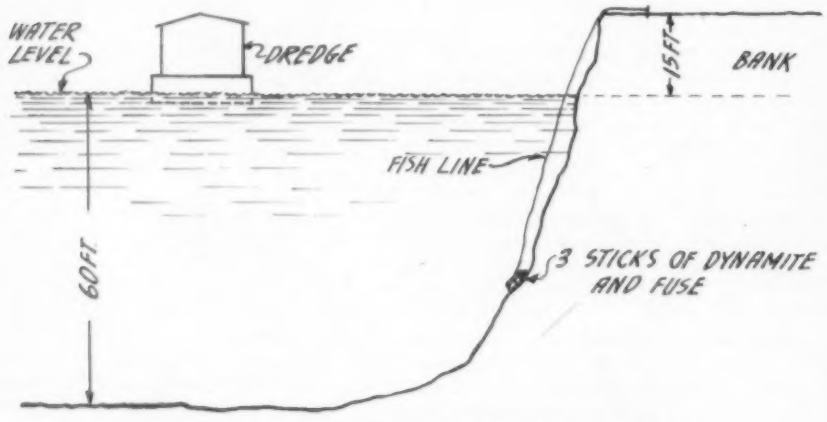
As shown in the illustration, the buckets are made with screen wire cloth fastened to sheet steel sides. Each bucket spaced at regular intervals is in turn fastened to the sprocket chain.

Blasting Down a Gravel Bank

AT A SOUTHERN SAND AND GRAVEL plant operation of a 10-in gravel pump delivers material to stationary screens located at a sufficient height to discharge the gravel direct to cars.

In the dredge pond they maintain a bank above water of roughly 15-ft. and dig to a depth of 60-ft. About the water line is a thin band of hard-pan which does not let the bank cave easily and also, owing to the nature of the material (70 percent sand—30 percent small sized gravel) results in the total bank assuming more or less of a vertical position which, if it did cave, would often endanger the suction line.

This bank is shot down in a novel method which works out quite satisfactorily. Three sticks of 40 percent dynamite are tied together with the fuse fastened to an ordinary fish line. After lighting the fuse the charge is thrown out into the pond and allowed to sink and finally come to rest 30 to 40 ft. below the water line and against the bank. The resulting blast does not cave the bank down in a body but loosens it sufficiently that it sluffs off from time to time without endangering the equipment and at a fast enough rate so that the dredge does not have to be moved often. At the time of shooting, the dredge is kept 75 to 100 ft. from the bank so as not to endanger the hull.



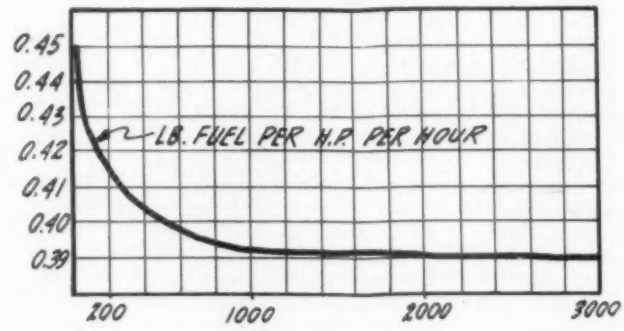
Sketch showing how bank of gravel was blasted down into water

Chart Diesel Data

By W. F. SCHAPHORST

"IF WE SHOULD INSTALL a Diesel engine how much fuel would it consume?" That question is often asked by men who are considering the use of a Diesel for power purposes.

Too often the question is side-stepped by salesmen who are afraid of committing themselves. They reply, "It all depends upon the size required," or words to that effect and the prospective user is mystified by the intricateness of the situation.



Curve showing fuel consumption of Diesel engines

In an effort to answer the above question definitely, data has been gathered on fuel consumption of modern Diesels of numerous sizes from which the accompanying curve has been developed. This curve tells at a glance what good Diesels are doing today, the horse power varying from the smallest sizes up to and including 3000 hp.

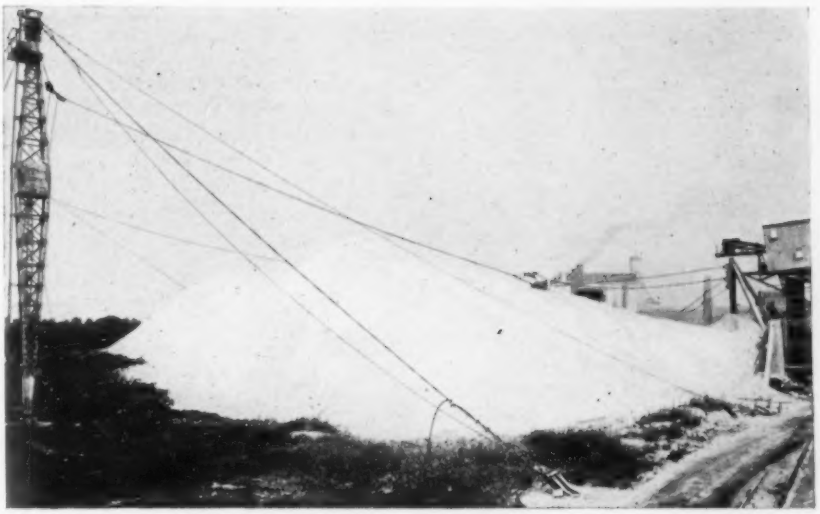
For instance, if the power requirements are very small, 50 hp. or even less, fuel consumption may be figured at 0.45-lb. per hp. hr. with a modern engine. If you need a 100 hp. Diesel, the consumption will be about 0.42 lb. per hp. hr. The curve shows that with increase in engine size the fuel consumption improves rapidly from the smallest sizes to 200 hp. From 200 to 1000 hp., the improvement is less rapid, and from 1000 to 3000 hp. the improvement is very slight, being practically 0.39 lb. per hp. hr. for all of the sizes in that range.

To determine the efficiency of any engine size, with any fuel, multiply the B.t.u. value of the fuel per pound by

the number of pounds per horsepower per hour and divide the product into 2546.

For example, if the fuel contains 20,000 B.t.u. per lb., and you will require a 500 hp. engine, the chart shows that you must multiply 20,000 by 0.40, which gives 8000 as the product. Now divide 2546 by 8000, and it will be found that the engine will have an efficiency of 31.8 percent, which is a high efficiency as compared with most engines of other types. It means that 31.8 percent of the heat contained in the fuel will be converted into work. Even at 0.45 lb. of fuel per hp. hr., other conditions being the same, the efficiency will be 28.3 per cent, which is a high efficiency.

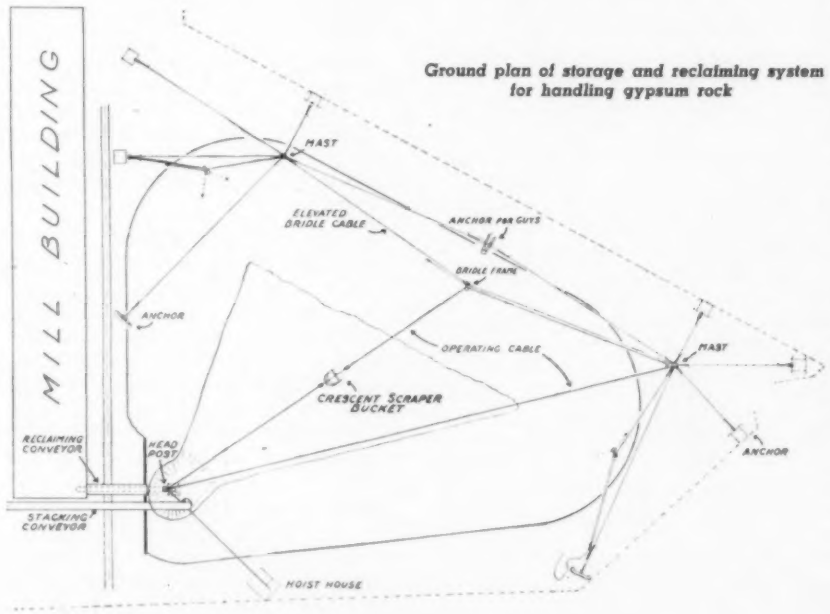
Handling Gypsum Supply With Drag Scraper



Drag scraper installation at British Plaster Board plant used for storing and reclaiming gypsum rock received by boat

TO KEEP PACE with production demands, the British Plaster Board, Ltd., near Erith, Kent, England, on the Thames river, has installed at its Belvedere plant some new facilities for storing and reclaiming crushed gypsum rock. The problem was to provide storage capacity so that the plant could obtain its entire year's supply of gypsum rock during the five months' navigation season, while low cost water transportation was available. About 80,000 tons of rock are stored in this period and then drawn upon at the rate of 400 tons per day during the remainder of the year.

Space available for storage was marshy and incapable of supporting any great weight, necessitating the use of light equipment and a low storage pile. The area was triangular in shape with its longest dimension about 330 ft. It was finally decided that a dragline scraper installation would be most satisfactory under the conditions imposed by the location. The scraper system consists of a 2-cu. yd. Crescent scraper bucket operated by a Sauerman electric scraper power unit. The scraper tail block is attached to a bridle frame which moves on an elevated bridle cable stretched between two steel masts set up at the outer corners of the triangular storage area. The tail block is moved along the bridge cable by means of small hand winches located near the base of each mast. At the forward end of the system is a Sauerman head post equipped with fair-lead blocks.



Ground plan of storage and reclaiming system for handling gypsum rock

During the summer months a ship arrives at the plant every 10 days with a cargo of 6000 tons of rock. The rock is unloaded by cranes and is delivered into the storage area at the rate of 200 tons per hour by a long belt conveyor, which discharges on to an initial storage pile alongside the head post of the scraper system. The initial pile accommodates about 2500 tons of rock. The reclaiming hopper is located directly under this pile and an apron feeder draws from this hopper 25 tons per hour for delivery to the process building.

About 40 hours of continuous operation is required to unload a ship, and during this period the scraper drags the rock no farther than the center of the storage area in order to obtain the highest storage rate. Between ship arrivals the material is dragged farther out so as to leave the forward part of the pile free to accommodate the next ship load.

With the close of navigation, the scraper system is used solely for reclaiming and the 2-cu. yd. bucket is replaced with a 1-cu. yd. bucket. The smaller bucket easily reclaims sufficient tonnage for the processing requirements, which amount to 400 tons per day.

An interesting operating feature is the scheme adopted to safeguard and expedite the operator's work during the heavy fogs that prevail throughout several months of the year. These fogs are so dense that it is impossible to see the bucket out on the storage pile, but by marking the operating cable the operator is able to guard against the danger of overrunning the scraper. This idea may be applied to operations in this country where foggy weather may prevail.

Recent Dividends Announced

Alpha P. C., com.	$ .25	June 25
Canada Cement, pfd	1.25	June 30
Lone Star Cement, com.	.75	June 30
Monolith P. C., 8% pfd ar.	.25	May 5
New York Trap Rock, 7% pf't.	7.00	annual rate
Ohio River S & G 1st pfd. ar.	.100	June 1
U. S. Gypsum, com, qu.	.50	July 1
U. S. Gypsum, pfd. qu.	1.75	July 1

ALPHA PORTLAND CEMENT CO., Easton, Penn., reports for the 12 months ended March 31, 1938, net profit of $138,550 equal to 21 cents a share against $1,020,993 or $1.58 a share in the previous 12 months.

LEHIGH PORTLAND CEMENT CO. Allentown, Penn., for 12 months ended March 31, 1938, shows net profit of $807,560 after federal income taxes, depreciation, depletion, obsolescence, etc., equal after deducting $229,140 dividends paid on 4% convertible preferred stock, to 77 cents a share on 754,434 shares (par $25) of common stock outstanding at close of the period. This compares with net profit for the 12 months ended March 31, 1937, of $2,318,054, equal after deducting $406,769 dividends paid on preferred stock to $2.67 a share on 716,123 common shares.

MATERIALS SERVICE CORP., Chicago, Ill., sand, gravel, crushed stone and lime, reports that earnings declined in 1937 to $102,906, before provision for federal income taxes, against $461,360 earned on the same basis in 1936. Accompanying the drop in profits was as 10.5 percent decline in sales which in the recent year amounted to $9,681,974, against $10,821,135 in 1936.

The consolidated balance sheet at December 31 showed $1,338,339 of current assets, establishing a ratio of 2 to 1 over current liabilities of $653,450. Included in the current liabilities were bank loans of $149,303 which compared with similar loans of $50,000 a year earlier. At that time the ratio of current assets to current liabilities was 2.3 to 1. Bank loans of $500,000 were shown as due February 1, 1939. Indicated net working capital at the close of the year was $702,889, against $987,451 December 31, 1936.

NEW ENGLAND LIME CO. North Adams, Mass., reports for the years ended December 31:

	1937	1936
Net sales	$550,110	$501,601
*Net income	20,092	16,708
Earned per share, com.	(d)$0.21	(d)$0.26

*After depreciation, depletion, Federal taxes, etc.

As of December 31, 1937, current assets were $147,211 and current liabilities $54,567, compared with $172,673 and $66,695, respectively, for the year ended December 31, 1936.

PENNSYLVANIA GLASS SAND CORP., Lewiston, Penn., reported for quarter ended March 31, 1938 (subject to annual audit) shows net profit of $70,913 after depreciation, depletion, interest and federal income taxes, but before surtax on undistributed profits, comparing with $175,264 in March quarter of previous year.

SUPERIOR PORTLAND CEMENT, INC., Seattle, Wash., reports for the year ended December 31, 1937, net profit of $428,363 after all charges including depreciation, depletion and federal income taxes, equal to $1.80 a share on 100,000 shares of class B stock after payment of regular dividends on 75,240 shares of $3.30 class A participating stock. On the basis of class A stock participating equally with class B in distribution of dividends in excess of $1.50 a share annually on class B, net profit for 1937 would be equal to $3.47 a share on class A and $1.67 a share on class B stock.

Participating dividend requirements were not invoked by the company in 1937 because of payment of only $1.50 a share on class B stock, this payment being made late in November to limit the company's liability for surtaxes on undistributed profits.

The company's 1937 shipments were the largest in the company's history. Edward P. Lucas, president, stated in his report to stockholders. Practical completion of the company's contract for cement for construction of Grand Coulee dam, with shipments exceeding previous estimates, more than offset the decline in construction and general demand.

"The rapid decline in all types of construction, together with continued importations of European cement and increasing sales of cement brought in from other states, combined to reduce our commercial sales in 1937 as compared with 1936," Mr. Lucas says. "During 1937 our plants were operated at approximately 65% capacity, compared with about 50% in 1936. Quarries at Concrete and Dall Island were operated part time only during the year.

"Indications at this time point to a very much lower sales volume in 1938 than in 1937, with resulting lesser earnings. The need exists for plant modernization at Concrete to keep our plant on a competitive basis for costs in the territory we serve. It is our hope that the tax on undistributed profits will be modified, at least to the extent where we are permitted to make necessary expenditures without too severe a penalty being imposed for not distributing earnings in the form of dividends."

The balance sheet of the company, as of December 31, 1937, shows current assets of $1,556,511 including $540,638 cash and current liabilities of $248,861. At the close of 1936, current assets amounted to $1,191,326, including $432,039 cash, and current liabilities were $323,289. Included in current assets at December 31, 1937, was work in process, an asset carried as a deferred asset in earlier statements. Inventories at the end of 1937 amounted to $697,028, compared with $410,591 a year earlier.

PENNSYLVANIA - DIXIE CEMENT CORP., New York City, and subsidiaries report for the 12 months ended March 31, 1938, shows loss of $73,356 after depreciation, interest, etc. but before federal income and undistributed profits taxes. For the 12 months ended March 31, 1937, the company reported net profit of $97,333 after charges and federal income taxes, equal to 80c a share on 121,200 shares of 7% preferred.

LONE STAR CEMENT CO., New York City, reports for the quarter ended March 31, 1938, subject to audit and year-end adjustments, a consolidated net profit of $726,237 after depreciation, depletion, federal income taxes, provision for contingencies etc., equivalent to 76c a share. No provision was made for surtax on undistributed profits. This compares with $735,704 or 76c a share in the March quarter of previous year.

COPLAY CEMENT MANUFACTURING CO., Coplay, Penn., reports for the years ended December 31:

	1937	1936
Operating income	$84,196	$160,565
Depreciation and depletion	114,149	109,289
Net operating income	(d)29,953	51,276
Other income	1,888	44,604
Total income	(d)28,065	95,880
Interest and amortization	19,631	20,790
Provision for taxes	17,312	6,968
Other deductions	627	24,074
Net income	(d)65,635	44,048
Preferred dividends		28,119
Surplus for year	(d)65,635	15,929
Earned surplus, Jan. 1.	274,097	258,168
Earned surplus, Dec. 31	208,462	274,097

Current assets as of December 31, 1937, were $549,316 and current liabilities $103,295, comparing with $611,778 and $71,032, respectively, for December 31, 1936.

FEDERAL PORTLAND CEMENT CO., Buffalo, N. Y., reported for the calendar year ended December 31, 1937, a net income of $10,391, after depreciation, federal income taxes, interest, etc. This meant a deficit of 57c per share, common stock.

LAWRENCE PORTLAND CEMENT CO., New York City, reported for the year ended December 31, 1937, certified by independent auditors, shows net income of $127,318 after interest, depreciation, depletion, federal and state income taxes including $2,500 surtax, equal to $1.70 a share on 75,000 no par shares of capital stock, against $328,132 or $4.37 a share on 75,000 shares in the preceding year.

Working capital as of December 31, 1937, was $1,368,898, against $1,210,313 on December 31, 1936. Inventories amounted to $847,303, against $702,703 at the end of the preceding year.

Recent Quotations on Rock Products Securities

Stock	Date	Bid	Asked	Dividends	
Aetna P. C., cap.[51]	5-19-38	20	..		
Allentown P. C. (Penn.), com.[51]	5-19-38	6	..		
Allentown P. C. (Penn.), 6% cum. pfd.[51]	5-19-38	7½	..		
Alpha P. C., com.	5-23-38	13	..	.25	June 25
American Aggregates, 1st mtg., 3/6's, 1943, new bonds[48]	5-16-38	81	83		
American Aggregates, com.[48]	5-16-38	2	3		
American Aggregates, pfd.[48]	5-16-38	20	30		
Arundel Corp., com.	5-25-38	16	..		
Ash Grove L. & P. C., com.[51]	5-19-38	10	..		
Ash Grove L. & P. C., pfd.[51]	5-19-38	90	..		
Basic Dolomite Inc., com.					
Bessemer L. & C., com.[48]	5-16-38	3½	4½		
Bessemer L. & C., pfd.[48]	5-16-38	21	23		
Bessemer L. & C., 1st 6½'s, 1947[48]	5-16-38	92	95		
Bessemer L. & C. 6's, 1955[46]	5-17-38	90	..		
Boston S. & G., com.[37]	5-16-38	¾	1½		
Boston S. & G., 7% pfd.[37]	5-16-38	4	7		
Boston S. & G., 7's, 1939[37]	5-16-38	75	..	Int. paid regularly	
Calaveras Cement, com.[40]	5-16-38	2½	4		
Calaveras Cement, 7% pfd.[40]	5-16-38	31	..		
California Art Tile, A[9]	5-19-38	10½	12		
California Art Tile, B[9]	5-19-38	1.15	2		
Canada Cement, com.[42]	5-24-38	9	9⅛		
Canada Cement, pfd.[42]	5-24-38	90	92	1.25	June 20
Canada Cement 4¼'s, 1951[42]	4-19-38	102½	103½		
Carolina P. C., 8% cum. pfd.[51]	5-19-38	48	..		
Consol. Cement, A[51]	5-19-38	1½	3		
Consol. Cement, 1st 6's, 1950[50]	4-19-38	52	55		
Consol. Okla. S. & G., 6½'s, 1948[42]	4-19-38	20	30		
Consol. S. & G., pfd.[50]	3-19-38	73	..		
Consol. Rock Products, units[50]	4-19-38	¼	..		
Consumers R. & G., 1st Mtg. 6's, 1948[51]	5-19-38	21½	24		
Consumer Co., 5's					
Coosa P. C., 1st 6's[51]	5-19-38	60	65		
Coplay Cement Mfg. units[50]	4-19-38	12	..		
Coplay Cement Mfg., 6's, 1941[50]	4-19-38	75	..		
Coronet Phosphate Co., com.				$1.25	April 1
Cumberland P. C., units[51]					
Dewey P. C., com.[51]	5-19-38	19	22		
Diamond P. C.[38]	5-16-37	7	8½		
Dolese & Shepard	5-19-38	24	25½		
Federal P. C., 5's, 1947[51]	5-19-38	50½	..		
Federal P. C., 6½'s, 1947[42]	5-18-38	51	54		
Fla. P. C., units[48]	5-16-38	25½	26½		
Fla. P. C., 6½'s, 1937[46]	5-17-38	100	..		
Giant P. C., com.[50]					
Giant P. C., pfd.[50]	4-19-38	6	..		
Glens Falls P. C., com.[51]	5-19-38	9	15		
Glens Falls P. C., pfd.[51]	4-20-38	75	..		
Great Lakes P. C., B[51]	5-19-38	¼	..		
Gyp., Lime & Alabastine	5-24-38	4¼	7		
Gyp., Lime & Alabastine, 5½'s, 1948[42]	4-19-38	93	95		
Hercules Cement, com.[51]	5-19-38	45	..		
Ideal Cement, com.[50]	5-24-38	22½	24½		
Kelley Island L. & T.					
Ky. Rock Asphalt, 6½'s, 1936[46]	5-17-38	40	..		
Ky. Stone Co., v.t.c.[46]	5-17-38	5	7		
Ky. Stone Co., 5%, 1956[46]	5-17-38	40	..		
Keystone P. C., pfd.[51]	5-19-38	30	..		
Lawrence P. C., com.	5-23-38	13¾	15¾		
Lawrence P. C., 5½'s, 1942[50]	4-19-38	97	100		
Lehigh P. C., com.	5-25-38	16	17½		
Lehigh P. C., 4% pfd.	5-25-38	105	..		
Lone Star Cement, com.	5-22-38	39½	40	.75	June 30
Louisville Cement	4-26-38	30	35		
Lyman-Richey, 1st 6's, 1939-40[51]					
Longhorn P. C. Co.[51]	5-19-38	6¾	8¼		
Marbelite Corp., com.[40]	5-16-38	.25	.40		
Marbelite Corp., pfd.[40]	5-16-38	3	4		
Marblehead Lime, 7's, 1944					
Marquette Cement, com.[50]	5-25-38	29½	31½		
Marquette Cement, pfd.[50]	4-19-38	102	..		
Material Service Corp.[50]	4-19-38	12	..		
McCrady-Rodgers, Class "A"	4-19-38	4	8		
McCrady-Rodgers, 7% pfd.[50]					
Medusa P. C., com.	4-22-38	17	..		
Medusa P. C., 6% cum. pfd.[51]	5-19-38	90	..		
Minnesota Mining & Mfg. Co.	5-25-38	27½	..		
Missouri P. C.	5-24-38	..	10½		
Monarch Cement, cap.[51]	5-19-38	85	..		
Monolith P. C., com.[9]	5-22-38	3½	5		
Monolith P. C., 8% pfd.[9]	5-21-38	7⅛	..		
Monolith P. C., 1st mtg.[9]	3-21-38	102	104	ar. .25	May 25
Monolith Portland Midwest, pfd.[9]	3-21-38	2½	3½		
National Gypsum, A., com.	5-24-38	6¼	..		
National Gypsum, 1st pfd.	5-25-38	12¼	13		
National Gypsum, 2nd pfd.					
National L. & S., 6½'s, 1941[46]	5-17-38	92	..		
Nazareth Cement, com.[50]	4-19-38	4	5½		
Nazareth Cement, 7% pfd.[50]	4-19-38	50	..		
Newaygo P. C., pfd.[51]	5-19-38	90	..		
New England Lime, units					
N. Y. Trap Rock, 7% pfd.[46]	5-17-38	60	..	$7.00	Annual Rate
North Amer. Cement, 6½'s, 1940[50]	4-19-38	60	..		
North Amer. Cement, 6½'s, 1942[50]	4-19-38	70	..		
North Amer. Cement, 1st 6½'s, 1953[50]	4-19-38	17	..		
North Amer. Cement, "A" pfd.[50]	4-19-38	2	2½		
North Amer. Cement, com. A[50]	4-19-38	¾	..		
North Amer. Cement, "B" pfd.[50]	4-19-38	4	5½		
Northwestern P. C., units					
Northwestern States P. C.[50]	4-19-38	19	21		
Ohio River S. & G., com.	4-26-38	..	1		
Ohio River S. & G., 1st pfd.	4-26-38	..	60	ar. 1.00	June 1
Ohio River S. & G., 2nd pfd.	4-26-38		4		
Ohio River S. & G., 6's[46]	5-17-38	12	..		
Oregon P. C., com.[40]	5-16-38	¾	1½		
Oregon P. C., 1st pfd.[40]	5-16-38	84	..		
Oregon P. C., conv. pfd.					
Pacific Coast Aggr., new com.[40]					
Pacific Coast Cement, com.[51]	5-16-38	1¾	1.90		
Pacific P. C., com.[40]	5-16-38	1½	2½		
Pacific P. C., pfd.[40]	5-16-38	40	50		
Peerless Cement, com.[50]	5-22-38	2¾	3¼		
Penn.-Dixie Cement, com.	5-25-38	3½	3⅝		
Penn.-Dixie Cement, pfd. A	5-25-38	16	19		
Penn.-Dixie Cement, 6's A, 1941					
Penn. Glass Sand Corp., pfd.[51]					
Penn. Glass Sand Corp., v.t.c.	5-25-38	11½	12½		
Penn. Glass Sand Corp., 1st mtg. 4½'s, 1960					
Petosky P. C., com.[50]	5-19-38	5	5½		
Riverside Cement, A[9]	5-21-38	5⅛	6½		
Riverside Cement, B[9]	3-21-38	1	1½		
Riverside Cement, pfd.[40]	5-16-38	2¾	3¼		
Rockland & Rockport Lime, com.[51]	5-19-38	¼	..		
Santa Cruz P. C., pfd.[9]	5-19-38	25	..		
Schumacher Wallboard, com.[9]	5-19-38	1.55	4		
Schumacher Wallboard, pfd.[9]	5-19-38	9¼	18½		
Signal Mt. P. C., com.[50]	4-19-38	1¼	..		
Signal Mt. P. C., pfd.[50]	4-19-38	49	..		
Signal Mt. P. C., units[51]	5-19-38	50½	..		
Southern States P. C., cap.[51]	5-19-38	40	..		
Spokane P. C., units					
Standard Pav. & Mat., com.[42]	4-19-38	2	3		
Standard Pav. & Mat., pfd.[42]	4-19-38	15	..		
Standard Silica, com.					
Superior P. C., pfd.					
Superior P. C., A[46]	5-16-38	32½	42½		
Superior P. C., B[46]	5-16-38	6½	..		
Southwestern P. C., units[46]	5-16-38	190	..		
Trinity P. C., units[50]	4-19-38	93	..		
U. S. Gypsum, com.	5-25-38	68	71	Q. .50	July 1
U. S. Gypsum, pfd.	5-25-38	167	169¾	Q. 1.75	July 1
Volunteer P. C., 1st 7's, 1942[46]	5-17-38	91	..		
Volunteer P. C., units[46]	5-17-38	78	..		
Vulcanite P. C., com.[48]	5-16-38	3	4		
Vulcanite P. C., 7½'s, 1943[46]	5-17-38	98	..		
Wabash P. C.[50]	4-19-38	8	..		
Warner Co., ww. 1st 6's, 1944[46]	5-17-38	64	66		
Warner Co., com.[50]	4-19-38	2½	4		
Warner Co., pfd.[50]	4-19-38	6	8		
Whitehall Cement Mfg., com.[51]	5-19-38	52	..		
Whitehall Cement Mfg., pfd.[51]	5-19-38	51½	..		
Wisconsin L. & C., 1st 7's, 1940					
Wolverine P. C., com.					
Yosemite P. C., 4%, pfd.[40]	5-16-38	2¾	3¼		

Quotations by [9]A. E. White Co., San Francisco, Calif. [24]The Securities Co. of Milwaukee, Inc., Milwaukee, Wis. [26]Merrill, Turber & Co., Cleveland, Ohio. [37]Wise, Hobbs & Seaver, Inc., Boston, Mass. [40]Martin Judge Jr., and Co., San Francisco, Calif. [42]Nesbitt, Thomson & Co., Ltd., Toronto, Ont. [46]First National Bank of Chicago, Chicago, Ill. [48]E. S. Ladin & Co., New York, N. Y. [50]Rogers & Tracy, Inc., Chicago, Ill. [51]Paul D. Sheeline & Co., Boston, Mass.

TRAFFIC and TRANSPORTATION

Proposed Rate Changes

THE FOLLOWING are the latest proposed changes in freight rates up to and including the week of May 14:

Central

44182. **Limestone**, broken, crushed, ground or pulverized, min. wt. 60,000 lb., Ashley Falls, Mass., Canaan, Conn., Cheshire, Mass., Danbury, E. Canaan, Fall Village, Conn., Farnams, Lee, North Adams, Mass., Redding, Conn., Renfrew, Richmond, Waltham, W. Stockbridge and Zylonite, Mass., to C. F. A. territory and Extended Zone "C" territory in Wisconsin. Present, as per Item 1215 of Agent Van Ummersen's I. C. C. 311; proposed. Reason: To provide New England shipper rates on a related basis to those from Trunk Line origins.

54408. To establish on **stone**, crushed; slag or gravel, coated with oil, tar or asphaltum,* in open top equipment, in straight or mixed C. L., from Muskegon, Mich., to South Bend, Ind., 194c; from Chicago, Ill., to Reed City, 257c, and Frankfort, Mich., 295c per net ton. Route—Muskegon to South Bend.

54422. To establish on (a) **sand**, naturally bonded moulding, in all kinds of equipment, C. L.; **sand** (except naturally bonded moulding, ground or pulverized sand), in closed equipment, C. L.; and (b) **sand** (except naturally bonded moulding, ground or pulverized sand), in open top equipment, C. L., from Brocton, N. Y., to various destinations in C. F. A. territory, rates on I. C. C. Dkt. 22907 joint scale.

54434. To establish on (a) **sand**, naturally bonded moulding, in all kinds of equipment, and sand (except ground or pulverized sand), in closed equipment*; (b) **sand**, ground or pulverized, in all kinds of equipment*; (c) sand (except naturally bonded moulding and ground or pulverized sand) in open top equipment; from Montdale, Ind., to Chicago, Ill., and Gary, Ind. (a) 121c, (b) 133c and (c) 94c per net ton.

54435. To establish on **stone**, crushed, coated with oil, tar and asphaltum, C. L., from Louisville, Ky., to Decatur, Ind., 244c per net ton.

54494. To establish on **sand** (except industrial) and **gravel**, in open top cars, C. L., from Columbus, O., to Fresno, O., 100c per net ton. Route—Via N. Y. C. R. R. direct.

54498. To establish on (a) **Sand**, naturally bonded molding, in all kinds of equipment, C. L.; sand (except naturally bonded molding; ground or pulverized) in all kinds of equipment, C. L.; **gravel**, in open top equipment, C. L.; sand (except naturally bonded molding; ground or pulverized sand), in open top equipment, C. L., from Phalanx, O., to Tremley, N. J. (a) 330c; (b) 363c, and (c) 330c per net ton. (Includes Ex Parte 123 increase.)

54528. To cancel rate of 87c per net ton, **crushed stone** or **stone screenings**, Marengo and Milltown, Ind., to Princeton, Ill., on shipments destined points on the C. & E. I. Ry., Index 41, page 13, Sup. 39 to Sou. Ry., Tariff 1184-H. Classification basis to apply in lieu thereof.

54545. Establish on **limestone**, ground or pulverized, unburnt, min. wt. 60,000 lb., Quincy, Ill., to Greenwood, Ind., 259c per net ton.

54566. Establish on concrete building or roofing slabs, with sheet of fibreboard on the underside, min. wt. 40,000 lb., between points in C. F. A. territory, from points in C. F. A. territory to points east of western termini of Eastern Trunk Lines, Class 25 rating.

54568. Establish on **limestone**, ground or pulverized unburnt, C. L., min. wt. 60,000 lb., Piqua, Marble Cliff, Hite, West Columbus, Ohio City, Middlepoint, Marion and Rockford, O., to Indiana destinations, rates on basis prescribed in scale in I. C. C. Dkt. 25220.

(Rates in cents per net ton)

To (Representative) Destinations in Ind.	Proposed Rates (*)	(†)	(‡)	(§)	(¶)	(£)
Bluffton	187	...	132	...	...	160
Bolivar	193	...	...	143	...	171
Butler	193	...	132	...	...	182
Churubuset	193	...	143	...	143	182
Columbia City	193	...	143	...	143	182
Crown Point	237	...	...	187	...	204
Decatur	182	...	121	105	110	160
DeLong	215	...	...	171	...	187
Fort Wayne	187	...	132	...	132	171
Huntington	193	...	...	132	138	171
Indianapolis	193	204	...	...	171	171
Kendallville	193	...	149	...	149	182
Kingsland	187	...	...	116	...	165
Kouts	226	...	...	182	...	193
Laketon	204	...	...	143	...	171
Logansport	204	...	171	...	165	182
Marion	187	...	132	...	143	160
Menton	204	...	...	...	165	182
Mishawaka	226	...	...	...	182	204
Muncie	182	...	...	...	143	143
Noblesville	193	...	...	...	171	165
Plymouth	215	...	171	...	171	187
Portland	182	...	138	...	...	138
Ridgeville	171	...	143	...	...	132
South Whitley	193	...	149	...	143	182
Wabash	193	...	160	...	149	171
Warsaw	204	...	160	...	160	182
Winchester	171	...	149	...	...	132

*From Marble Cliff, O., Hite, O., West Columbus, O.
†From Marion, O.
‡From Middlepoint, O.
§From Ohio City, O.
¶From Rockford, O.
£From Piqua, O.

Where rates today published conflict with rates proposed herein, such present rates are to be cancelled simultaneously with the effective date of proposed rates.

All rates on **limestone dust**, C. L. (see Note 1), from and to the points involved herein also to be cancelled simultaneously with effective date of rates proposed herein.

54590. Establish on **limestone**, ground or pulverized, unburnt, min. wt. 60,000 lb., Speed, Ind., to Princeton, Ind., 182c per net ton.

54631. Establish on **sand**, naturally bonded moulding, in all kinds of equipment; **sand** (except ground or pulverized), in closed equipment, C. L., Koppel, Penn., to Manlius, N. Y., 275c per net ton, via P. R. R., East Buffalo, N. Y., West Shore R. R.

54632. Establish on **sand and gravel**, C. L., Cayuga, Ind., to Charleston, Ill., 50c per net ton.

Trunk

36709. **Marl**, ground or unground, C. L., min. wt. 60,000 lb., from Verona, Va., to Chester Springs, Penn., $2.59 per net ton in lieu of present 22c per 100 lb. (Column 22½.) Reason: Reflects ground limestone rates prescribed I. C. C. Docket 25220 plus Ex Parte 123 increases.

36712. **Stone**, natural (other than bituminous asphalt rock), crushed, coated with oil, tar or asphaltum,* C. L., (See Note 3), from Bedford Hills, N. Y., to Long Island R. R., Group A $2.09; Group B, $2.31; Group C, $2.42, and Group D, $2.75 per net ton, in lieu of present 6th class per W. S. Curlett's I. C. C. A445. Reason: To Group A points made 70c over joint Martinburg scale, observing 10 cents over plain crushed stone as a minimum, Groups B, C and D recognized arbitraries over Group A.

36713. **Ground limestone**, C. L., min. wt. 60,000 lb., from Oriskany Falls, N. Y. Proposed rates to L. V. R. R. destinations which are in lieu of present 6th class. Reason: Reflects I. C. C. Docket 25220 scale increased under Ex Parte 123.

36721. **Stone**, crushed, coated with oil, tar or asphaltum, in bulk, in open top equipment,* C. L. (see Note 3), from J. C. Stahl, Penn., to Marion, Penn., $1.80 per net ton and North Point, Penn., $1.95 per net ton, in lieu of present class rates.

36725. **Sand**, naturally bonded molding, in open top or box car equipment, C. L. (see Note 3), from Catasauqua, Penn., to Hamburg, Penn., $1.21 per net ton, in lieu of present class rates. Reason: I. C. C. Docket 22907 Scale increased under Ex Parte 123.

36726. To cancel rates on **sand** and **gravel**, common or building, C. L., from Richland, N. Y., to destinations on the N. Y. C. R. R., as per I. C. C. N. Y. C. R. R. 15844, class rates to apply. Reason: No present or prospective movement.

36739. **Limestone**, ground or pulverized, C. L., min. wt. 60,000 lb. from Gouverneur, N. Y., to Ticonderoga, N. Y., $2.15 per net ton, plus 14c per gross ton, in lieu of present 6th class rate.

36751. **Pyrites cinder**, C. L. (See Note 3), from Phoenix, N. J., to Bowmanstown, Penn., $1.53 per gross ton, in lieu of present class rate. Reason: Account of comparable rates to other destinations.

36753. **Asphalt filler**, C. L., min. wt. 60,000 lb., from Marriottsville and Sykesville, Md., to Garwood, N. J., $2.42 per net ton, in lieu of present rate $2.53. Reason: Account of comparable rates for similar movements.

Sup. 1 to 36665. Naturally bonded moulding **sand**, C. L. in open or closed cars. (See Note 1), from Jersey City and Weehawken, N. J., to Chicago, Ill., 27c per 100 lb., in lieu of present 6th class rate 42c.

36756. To cancel switching rate of 50c per net ton on **sand**, **gravel** and **crushed stone**, C. L., from private sidings on the Western Maryland Ry. Co. to Public Team Track deliveries on the B. & O. R. R., within the switching limits of Cumberland, Md., published in Western Maryland R. R. I. C. C. 8363.

36768. To cancel commodity rates on **pyrites** and **pyrites cinder** from Philadelphia, Penn., to Matawan, N. J., and on **pyrites**, **pyrites cinders** and **copper concentrates**, C. L., from Lebanon and Steelton, Penn., to Matawan, N. J.

Southern

16710. **Stone**, broken or crushed. Establish from Ohio and Miss. River crossings, Items 1286, 1401 and 1405, as amended, S. F. T. B. Tariff 66-G, when originating at Mount Airy, N. C., the same rates to the same destinations as now applies when originating at points in Southeastern territory.

16726. **Gravel**, C. L. Cancel intrastate rate of 65c net ton from Estill Springs, Tenn., to Lewisburg, Tenn., allowing standard rate of 99c net ton to apply.

16732. **Feldspar**, C. L., min. 60,000 lb. Establish 308c net ton. Minpro, Sprucepine and Toecane, N. C., to Laurens, S. C.

16744. **Sand**, C. L. Cancel rates published in Clinchfield I. C. C. 142 from Bostic and Logan, N. C., to N. & W. Clinch Valley division stations, Richlands to Norton, Va., incl.

Southwestern

13813. Provide for application of Class 22½ rating applied to April 9, 1937, class rates, min. wt. 60,000 lb., on **mica**, dry, ground, C. L., min. wt. 60,000 lb., from, to and between southwestern and Kansas-Missouri territories.

Western

E-41-245. **Stone**, crushed, C. L., from Ablemans, Wis., to Sandwich, Ill. Rates, present, 11c per 100 lb.; proposed, 8½c per 100 lb.

*Note—The oil, tar and/or asphaltum not to exceed 10% by weight of the commodity shipped, the shipper to so specify on shipping orders and bills of lading.

Note 1—Minimum weight marked capacity of car.

Note 2—Minimum weight 90% of marked capacity of car.

Note 3—Minimum weight 90% of marked capacity of car, except that when car is loaded to visible capacity the actual weight will apply.

Concrete Products
Cement Products
TRADE MARK REGISTERED WITH U. S. PATENT OFFICE

Concrete Masonry Wall Sets New Record In

FIRE TEST

FIRE, WATER AND PRESSURE were used at the Underwriters' Laboratories, Chicago, Ill., to determine the fire protection provided by a new type of concrete masonry unit. Tests of the 11-x10-ft. wall, constructed of solid concrete masonry units, 8 in. thick, were recently witnessed by members of the Chicago Building Code Council Committee, members of the Engineers' Code Committee and independent engineers and architects. The result of the test, which continued for more than 4 hrs., will be announced as soon as all the data have been studied and all the computations checked.

The masonry units used in the test wall were made at the Elmhurst-Chicago Stone Co.'s block plant, Elmhurst, Ill. The Portland Cement Association sponsored the test. According to W. G. Kaiser, manager of the Cement Products Bureau of the Portland Cement Association, these blocks will soon be available and will provide an economical material for fire resistant construction of fire and party walls in multiple dwellings and commercial buildngs.

The solid units used in the wall were designed to meet the requirements of the building codes of New York (1938), Chicago (1937), and the National Board of Fire Underwriters (1931). This test was the first official fire test of concrete masonry units designed to meet the specifications of these codes for units having a core area of not more than 25 percent.

Test Procedure

In a large furnace specially designed at Underwriters' Laboratories for fire tests, and burning 10,000 cu. ft. of gas per hr., the wall was subjected to four hours of fire exposure. In the first 5 minutes of test, the fire raised the temperature to 1000 deg. F. At the end of one hour the temperature of the exposed face of the wall was 1700 deg., at two hours 1850; at three 1925, and at four hours and the completion of the exposure, the temperature was 2000.

During the entire test the wall was loaded by means of hydraulic jacks, which exerted a pressure of 175 p.s.i. This pressure was adjusted during the test so as to remain constant in spite of the expansion of the wall.

At the end of the 4-hr. fire exposure, the red hot wall was immediately withdrawn from the furnace and a hose stream was played over the incandescent face which had been next to the flames. The hose stream was directed from a distance of 20-ft. and issued from a 2½-in. fire hose at 45 p.s.i. Clouds of steam were developed as the water struck the hot face. The hose stream duplicated the condition which might exist in an actual fire. It was played back and forth across the wall for 5½ minutes, a time determined by the area of the wall. The wall remained intact after this test, only slight surface spalling resulting.

To the left: Inserting themocouples before applying fire test. Center: City officials examining wall after test. Right: Stream of water applied to hot wall

How to Profit on PCA Advertising

Happy *are the homes where*

CONCRETE

brings beauty, comfort, low upkeep and security from fire

Charming—*and firesafe!*—is the home of Mr. and Mrs. Edmund A. Smith, Richmond, Virginia. Concrete walls, partitions and floors and a firesafe roof. Architects: Lee, Ballou & VanDervoort, Inc. Builder: J. H. Beamett.

THERE'S pride of possession as well as solid comfort in a concrete home. For, no matter what architectural style is selected, no matter what color or surface texture you choose, concrete's beauty and charm endure for generations. And the concrete home remains delightfully livable because it is snug and dry in winter, cool in summer—because it is permanently free from sagging walls and creaking, uneven floors.

There's security in owning a concrete home, not only from fire and storm, but from the financial risk of unexpected and burdensome upkeep costs. Concrete adds only a few dollars to your monthly payments. Often the cost is no more than for ordinary construction—and you save money through lower upkeep and higher resale value.

CONCRETE FLOORS—sagproof, warm, quiet—will make your new home a joy. They banish the dread of basement fires. They take any covering—such as wood, carpet, tile or terrazzo—varied from room to room if you like.

How to Get a Concrete Home

Ask a Concrete Contractor or a Concrete Masonry Manufacturer *(see classified phone directory)* for names of architects, builders and realtors experienced in concrete construction. Write us for free booklet of attractive design ideas.

PORTLAND CEMENT ASSOCIATION
Dept. 4E, 33 West Grand Avenue, Chicago, Illinois

In scientific laboratories, and on construction jobs, the Portland Cement Association is cooperating with engineers, architects and builders to perfect safer, more enduring pavements . . . better homes and structures . . . better concrete for bridges, dams, sewers, farm improvements. Helpful booklets available on hundreds of subjects.

ADS LIKE THIS in the *Saturday Evening Post*, *Better Homes & Gardens*, and *Holland's* magazine every month are telling the people of your town about the advantages of CONCRETE HOUSES.

ADS LIKE THIS which you can run in your local newspaper over YOUR signature will tell them to come to YOU for help in getting a charming firesafe concrete house.

LET US BUILD YOU A BEAUTIFUL CONCRETE HOUSE

such as you see advertised in the national magazines.

It's the fast-growing better way to build—firesafe and enduring—cozy and livable.

Ask us for facts and an estimate before you build.

YOUR NAME
should be printed here

PORTLAND CEMENT ASSOCIATION
Dept. A6-45, 33 W. Grand Ave., Chicago, Ill.

Yes, I want to tie in with the PCA's national advertising campaign.

Send me FREE the set of mats for small newspaper ads so I can insert them with my name in the local newspaper.

NAME _____

ADDRESS _____

SEND THE COUPON *for a free mat of this and similar ads which you can use to bring profits to you.*

Your newspaper will be able to reproduce them and add your name and phone at the bottom.

Concrete Products Solve An Engineering Problem In

LAYING FLOORS

By BROR NORDBERG

A DIFFICULT ENGINEERING PROBLEM in placing concrete floors in the new Vanderbilt University Hospital, Nashville, Tenn., was solved by the use of concrete products. Concrete filler tile was adopted in constructing floors in this outstanding building to control the cracking of the concrete slab due to volume change. Along with this new development, concrete floors were levelled to within ⅛-in., by means of a levelling screed fastened to a rib on the floor tile, so that the wearing surface could be applied without a slab fill over the structural concrete.

The floor filler tile, "Breeko Tile," manufactured by the Nashville Breeko Block and Tile Co., Nashville, are the units which have been so successfully introduced in recent years for floors in the larger buildings in competition with other types of construction.

The accompanying cross-section of this cinder concrete unit illustrates its design and outstanding features. On the upper surface of the tile is a lug, or rib, which provides a levelling guide for strike-off or screeding purposes in placing the concrete slab, and is the nailing base for placement of a wood floor finish. Floors constructed with these cinder concrete units have a flat ceiling surface which provide an excellent bond for the ceiling plaster.

Floor tile dimensions are dependent upon the municipal building codes which often limit or define the thickness of concrete slab construction.

About 90,000 of these cinder concrete floor tile were used in constructing the floors of the new Vanderbilt University Hospital. The units are 8- x 16-in. in size, and 6-, 8- and 10-in. depth tile were used on this job. The nailing rib, which is the outstanding feature of the tile, was the means of controlling cracking in all floors of the hospital. The new floor construction was the result of a study by Henry C. Hibbs, Nashville architect, in coöperation with the Nashville Breeko Block and Tile Co., and the installation was made by Foster and Creighton Co., Nashville general contractors.

Cracking control and positive floor levelness were accomplished by nailing metal strips to the ribs of the Breeko concrete floor filler tile in such a way that these strips could be accurately levelled and spaced to take between them standard sections of "temperature" steel mesh.

The levelling strips, or "crack strips," are standard-weight plasterer's 1-in. base screeds, and the concrete slab is 3-in. thick. For this construction, the units were cast with a nailing rib 1⅝-in. in height. The screed or crack strip, is set by driving an ordinary roofing nail 1-in. below the top surface of the slab to be poured. This leaves approximately ⅜-in. between the roofing nail head and the top of the nailing rib, which is filled with a 1:2½ cement grout and rodded to the top of the nails. These strips were placed, set to a level and nailed on every fourth nailing rib, giving a spacing of 7-ft. between strips throughout all the floors.

"Temperature" mesh steel was stretched taut from strip to strip and supported on the nailing ribs of the tile. The ribs acted as a succession of continuous chairs to securely hold the "temperature" steel in place when nailed to the lugs.

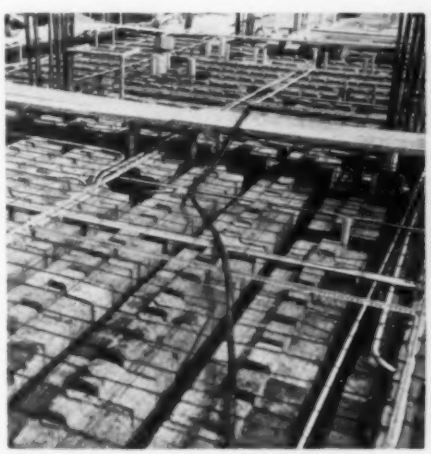
By having the "temperature" steel mesh sections supported in this way, the superimposed concrete slab, made with sand and gravel aggregate, is caused, in setting, to shrink at the strips in a straight, controlled line instead of in irregular cracks.

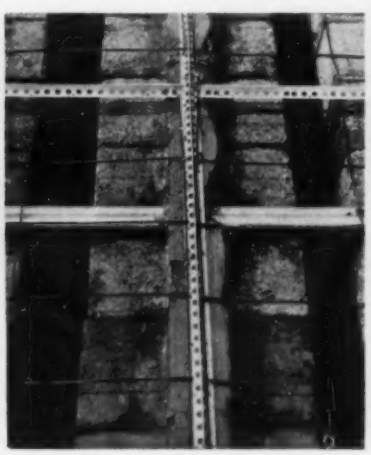
An almost invisible shrinkage crack is formed in the floors along each strip These cracks close entirely when the slab is warm and permit expansion and contraction of the concrete slab as a whole without the occurrence of any irregular cracks. By spacing the metal strips on 7-ft. centers, none of the controlled cracks are large enough to affect the floor job structurally and none are noticeable at all through the finish.

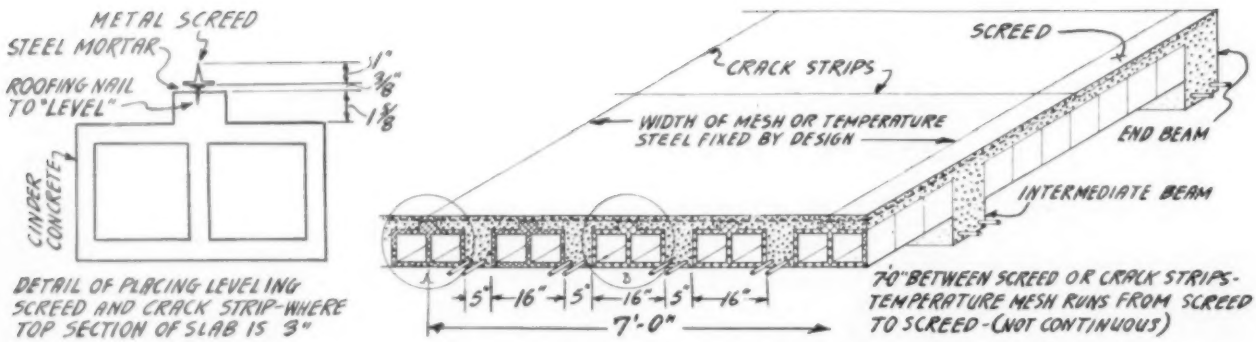
These strips also perform the added function of screed strips for leveling off the structural concrete floor surface, the contractor claiming an accuracy within ⅛-in. in levellness. With such accuracy, it was unnecessary to place any kind of floor fill over the slab before laying the composition asphalt tile wearing surface.

The architect and contractor on this

Left: Screed strips nailed to the floor filler tile; "temperature" mesh steel and conduits in place before pouring slab. Center: Closeup showing how screed strips are nailed to the nailing rib of concrete floor tile. "Temperature" steel mesh is not continuous but terminates at the screed to control cracking. Right: Screed strips nailed to the floor filler tile aid in levelling floor in Vanderbilt University Hospital construction







Left: Cross section of cinder concrete floor tile showing how leveling screed is applied. Right: Floor construction details using cinder concrete tile, leveling screed, and "temperature" mesh steel to prevent irregular cracks and provide for expansion

project found the cost of this construction to be very reasonable, and its simplicity was of great value in carrying on the work.

Openings for Conduits

Another advantage to the contractor is in the placing of conduit and piping. Breeko filler tiles have depressions for the passage of conduit and piping at right angles to the nailing lugs, which permits placing these utilities below the "temperature" steel mesh without any cutting of tiles on the job. For places where a multiplicity of pipes or large conduits occur, lanes or paths were formed with smaller tiles to allow all pipes and conduits to be carried well below the "temperature" steel mesh.

With the more conventional type wood floors nailed to the nailing ribs, the floor filler tile has already gained wide acceptance, having been placed in a number of the larger, prominent buildings in Nashville.

This construction job is one in which the manufacturers of "Breeko tile" may well take pride, and reveals again how concrete products can be adapted to large type construction and to engineering design. Patents have been applied for to cover this type of floor construction.

The patent for the floor filler tile, designated "Breeko," is controlled by the Breeko Corp., Nashville, Tenn., of which the Nashville Breeko Block and Tile Co., is a licensee. At present the Breeko Corp. is materially enlarging its merchandising and sales plan by promoting and selling "Breeko" concrete floor filler tile in the east. The Breeko Corp. also controls the patent for "Breeko Block," a 12- x 24-in. cinder concrete unit designed for low cost partition wall construction in the larger type of building.

Among the properties claimed for this new block are speed of laying, nailability, a true surface for plastering, a high degree of sound and heat insulation, and ease in splitting by the masons on the job. These units, produced in 2-, 3-, 4-, 6- and 8-in. thicknesses, were used in constructing partition walls in the Vanderbilt University Hospital, and they have met with favor among leading architects and contractors in Nashville.

Charles W. Akers and H. V. Hopton head the Breeko organization.

WOODLAKE CONCRETE PRODUCTS CO., Woodlake, Calif., operated by Abe Upp and John T. Washburn, has added new machinery to manufacture concrete pipe which is used for irrigation systems.

GENE VALLETTE, president of the City Transfer Co., Casa Grande, Ariz., is now manufacturing concrete bricks, blocks, and tile. These new products are being made with a Graystone vibrator machine which has a capacity of 2000 bricks per day.

FRANKLIN CONCRETE PRODUCTS, INC., 45 West Barthman Ave., Columbus, Ohio, has filed notice of dissolution of the corporation.

Detroit Draws Largest Attendance in History to

Concrete Burial Vault Convention

DETROIT, MICH., was host to the ninth annual National Concrete Burial Vault Association convention which began its sessions on Tuesday morning, May 10, in the Hotel Statler. Directors had met the previous day to consider some matters and hearty approval was given to the program arranged by President Dahlquist and the Detroit Convention committee, headed by Chairman E. J. Rogers.

The convention was called to order by President H. A. Dahlquist, and following the invocation and addresses of welcome by representatives of the city government and the Detroit Convention Bureau, President Dahlquist responded with some very fitting remarks. Registration began a little earlier than the scheduled hour of 8:30, and it was soon evident that the attendance at this convention would exceed that of any in the past. As the visitors registered, they passed into the main meeting room where there had been arranged various advertising displays—exhibits of stationery, office and factory forms including all printed matter used in the shops and offices of concrete burial vault manufacturers.

Lady visitors were registered at the same time, and at 10 a.m. they boarded the bus for Greenfield Village at Dearborn as guests of the Michigan concrete burial vault manufacturers. Lunch was served at Dearborn Inn. The ladies were unanimous in praise of Mrs. Rogers as hostess.

Election of Officers

While the ladies were enjoying the trip, the delegates got down to the business of the convention. The report of the secretary-treasurer was read and approved, and then the election of officers was held. Two directors' terms expired, H. E. Coburn of Massachusetts and G. M. Painter of Pennsylvania. Mr. Coburn was elected to succeed himself as director. Charles E. Willbee of Michigan succeeded Mr. Painter. Several speeches were made urging President Dahlquist to accept again the office of president, because of the exceptional executive ability he had displayed in conducting association affairs during the past year. However, it was impossible to persuade Mr. Dahlquist to accept and Vice-president Coburn was elected to succeed him. He was warmly congratulated by President Dahlquist, and was assured of Mr. Dahlquist's loyal support in all matters pertaining to association welfare. Several nominations were made for vice-president, and A. M. Lendrum of Ohio was elected to the position. R. W. Mead was re-elected secretary-treasurer.

The Progressive Service Conference, conducted for the benefit of the Funeral

H. E. Coburn

Directing Industry, was reported on by H. E. Coburn and others who had attended them in the various cities of the country in which they had been held. Mr. Newcomer's remarks were said to have been timely and to the point, and of much benefit to the funeral industry.

The Constitution and By-Laws committee then made its report. Past President Hilles acted in place of F. J. Mead, chairman of the committee, who was unavoidably absent. This committee was warmly commended for the work it had done in revamping the Constitution and By-Laws, originally adopted nine years ago, and in incorporating the various amendments since made into a more condensed and workable set of rules for convention procedure. A few minor changes suggested by members present were adopted, but on the whole the revision as recommended by the committee was unaltered and was retained.

Funeral Directors' Views

Edgar C. Marshall, funeral director of F. G. Marshall Sons, Inc., Detroit, Mich., read a very well prepared paper entitled "Funeral Directors' Views on Burial Protection." Mr. Marshall's comments were very much to the point, and brought out many facts appreciated by those who are making better burial protection and are endeavoring to make the phrase "Concrete Burial Vaults for Better Protection" more prominently identified in the public mind.

Adjournment was taken for lunch, which had already been arranged for round table discussion. Various topics had been assigned for consideration at the several tables, and the visitors seated themselves where the subject seemed of most importance to them.

The afternoon session included a talk by Mr. Jefferies, relative to Industrial Insurance. He showed that he had gone into the matter most thoroughly. He urged every manufacturer to adopt all safety measures possible to prevent accidents and thereby decrease the rate imposed upon our particular industry.

Vacuum Concrete

The vacuum concrete demonstration was conducted by W. F. Lockhardt in a room adjoining the Association meeting room, fitted up for a laboratory. The demonstration paved the way for remarks by Mr. Woodworth, engineer of the Portland Cement Association. Mr. Woodworth showed why the grading of the aggregates going into concrete burial vaults must be accurate and a certain formula of sizes adhered to in order to produce concrete for the best burial protection. Much interest was displayed in the vacuum concrete demonstration, and the program was extended beyond the scheduled time.

Banquet

At 7 o'clock the guests assembled for the banquet. President Dahlquist made the opening remarks and introduced E. J. Rogers, chairman of the convention city committee. He spoke a few words of greeting and presented Charles E. Willbee, master of ceremonies. A very enticing menu was set before the guests after which very short speeches were made by a few of those present. A very entertaining program was presented. A ventriloquist with his dummy, Skinny Dugan, created much laughter and amusement, especially when he called by name some of the members and referred to their hobbies. The banquet broke up at a late hour, and many went to the ballroom to dance.

The Wednesday morning session began with a breakfast round table where various subjects were discussed.

At the opening of the meeting Mr. Coburn, the newly elected president, took the floor to make his committee assignments. Mr. Washburn, a member of the state legislature of New York, then made a report on the Municipal Mortuary Bill. This will be printed in full and made available to N. C. B. V. A. members.

Analyzing Tomorrow—Today

He was followed by Wilber M. Krieger, executive secretary of the National Selected Morticians. His address was "Anaylzing Tomorrow—Today." Mr. Kreiger's address proved to be the best feature of the entire program. He pointed out most emphatically some of the present errors and the methods of correcting them. Mr. Krieger intimated that his remarks would be of more benefit to those who were not present and took little interest in what they were manufacturing rather than to those concrete burial vault manufacturers who were making a good product and regularly attended conventions. Mr. Krieger's lecture will be printed in full, and a copy will be available for every member of the National Concrete Burial Vault Association.

John Harkness, an engineer on reinforcing from Chicago, gave a very interesting talk, and produced numerous samples to show the need of engineering methods in manufacturing the kind of burial protection that protects. He brought out the difference between the poorly constructed vaults in which no attention is paid to the relation between the concrete mass and the reinforcing used, and the vaults that are produced according to specification standards.

Next Meeting at Pittsburgh

The first matter taken up on the afternoon program was the report of the 1939 convention city committee. D. I. Roland of Iowa, chairman of this committee, after reading the various invitations, opened the discussion. Pittsburgh was the place finally chosen, and J. S. Hamilton of Pittsburgh was made convention city chairman. The date of the 1939 convention will be determined at a later directors' meeting.

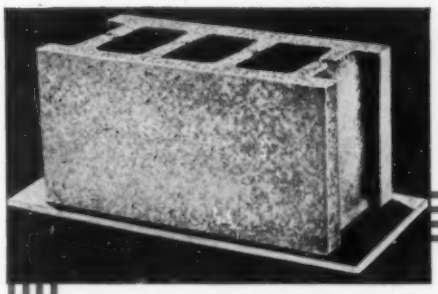
Mr. Horace D. Kerr of Cleveland delivered a most inspiring address on the "Value of Publicity" and brought out facts relative to advertising which were both enlightening and surprising.

Following Mr. Kerr's address, the convention was adjourned. On Thursday, 92 members and guests were transported in buses to Pontiac, Mich., where they were taken on an inspection trip through the Coach and Truck Division plant of General Motors Corp.

It was the best attended convention that the National Concrete Burial Vault Association has held. President Dahlquist and the Detroit convention committee consisting of E. J. Rogers, chairman; Charles E. Willbee, who acted as banquet toastmaster; V. L. Abbott, Martin Kornoelje, and Herman Witte were warmly praised for the exceptional features they had incorporated in the three-day session. Many commented that it was the most instructive program ever attended.

Pre-cast Concrete

Concrete Products, Inc., Marion, Ohio, a new company, started construction of a new $15,000 plant on May 1, to provide facilities for the manufacture of pre-cast concrete units for levees, overpasses, roofs, floors, wharves and docks and also ornamental castings for interiors and gardens. W. H. Evers, a Cleveland, Ohio, engineer, is president; and Thad Kuenzil of Nevada, Ohio, is secretary. It is planned to start production in August with about 50 men.

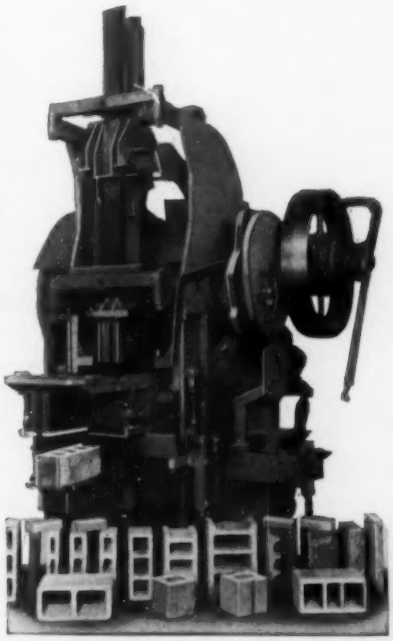


BEAUTY THAT STANDS OUT
QUALITY THAT STANDS UP

FULLY PRESSED TOP concrete masonry units combine both beauty and the qualities that make strength in units and in walls. For their beauty FULLY PRESSED TOP units have become popular in high-class construction. Beautiful low cost homes, also, are being built with these units which cost no more to make.

FULLY PRESSED TOP units are better for back-up and partitions because they lay up more easily into perfectly aligned walls which are stronger because bearing stresses are even.

Albert E. Bill, Detroit, Mich., Builder. Concrete Masonry Units made on Besser Plain Pallet Strippers by Cinder Block Inc., Detroit, Michigan.

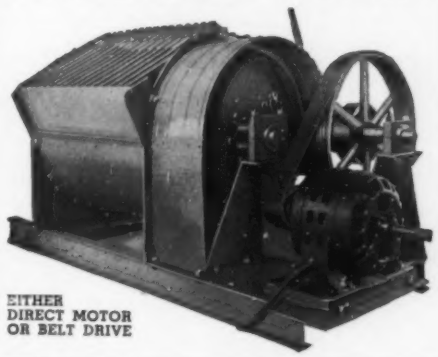


Fully Pressed Top Units are made only on Besser Plain Pallet Strippers. All Units are made on one set of Plain Wood or Steel Pallets.

BESSER BATCH MIXERS

In All the Standard Capacities

5, 12, 18, 25, 30, 40 and 50 Cubic Feet



EITHER DIRECT MOTOR OR BELT DRIVE

BESSER PLAIN PALLET STRIPPERS

The Saving in Pallets Pays for a Besser Plain Pallet Stripper

FULLY AUTOMATIC—3 models—Capacities: 2000 to 4000 units per day.

SEMI-AUTOMATIC—4 models—Capacities: 1000 to 2000 units per day.

POWER OPERATED with Hand Controls—2 models—Capacities: 800 to 1500 units per day.

MULTI-MOLD—Hand Operated—Capacities: up to 300 units per day. For manhole blocks, brick, slabs and small cored units.

AUTOMATIC BRICK MACHINES—Capacities from 10,000 to 50,000 units per day. For brick, slabs, coal cubes and other small units.

Besser Plain Pallet Strippers are made under one or more of the following Patents of which Besser Mfg. Co. is sole owner.

No. 1,472,399 by S. H. Pettengill
No. 1,572,305 by A. P. Nelson
No. 1,699,218 by J. H. Besser
No. 1,706,647 by J. H. Besser

These are the only patents ever granted on concrete stripper block machines using plain pallets, and they completely cover the basic plain pallet stripper principle. Other patents pending on improvements. No firm or individual is licensed or allowed to make machines under any of these patents.

BESSER MANUFACTURING CO.

COMPLETE EQUIPMENT FOR CONCRETE PRODUCTS PLANTS

Complete Sales and Service on BESSER, ANCHOR, CONSOLIDATED, IDEAL, HOBBS, UNIVERSAL, PORTLAND

206 38TH STREET **ALPENA, MICHIGAN**

EVERY CONCRETE PRODUCTS PLANT NEEDS A BESSER PLAIN PALLET STRIPPER

Cranes, Tractors and Highway Transport Promote

EFFICIENCY in PIPE PRODUCTION

As Described by
GEORGE E. SMITH
Supt., Illinois-Wisconsin Pipe and Tile Co.

IN ITS 17 YEARS OF EXISTENCE, the Illinois-Wisconsin Concrete Pipe and Tile Co., South Beloit, Ill., has placed emphasis on quality in the manufacture of concrete drain tile and plain and reinforced concrete sewer and culvert pipe. These products are made to conform to A.S.T.M. specifications with a wide margin of safety over and above the standard requirements, and the specifications of the states of Illinois and Wisconsin for heavy duty, reinforced culvert pipe.

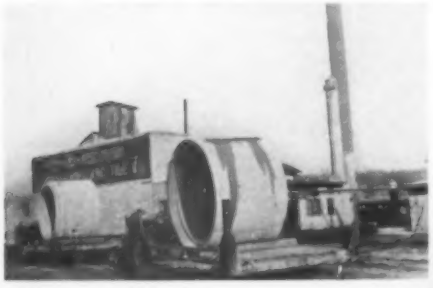
Pipes are manufactured on Quinn and McCracken machines in sizes from 4-in. to 60-in. in diameter, and forms are available for pouring pipe in larger sizes. The Quinn is a heavy duty tamping machine served by a triple turntable while the McCracken is a centrifugal packerhead machine.

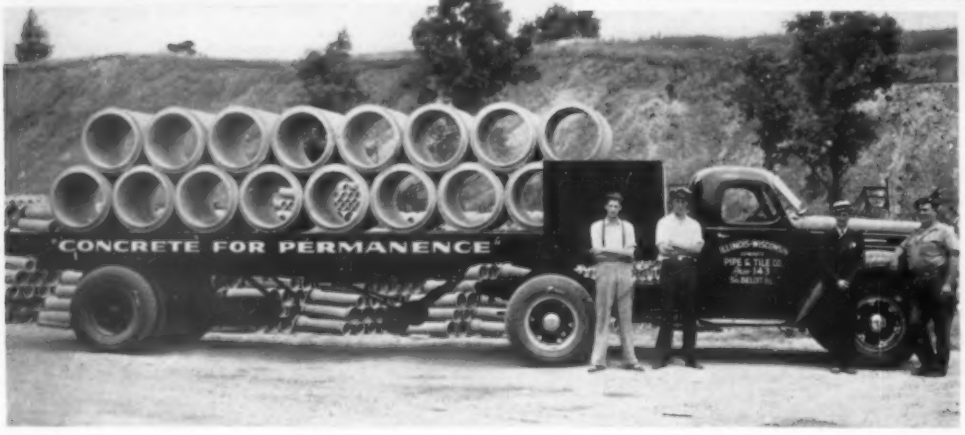
Sand and gravel aggregates are used in making all pipe. The aggregates are furnished by an affiliated concern, the Atwood-Davis Sand Co., South Beloit, Ill., which affords facilities for securing washed, hard, and properly graded materials for well-designed mixtures. The mixes are accurately controlled by the use of Johnson weigh batchers.

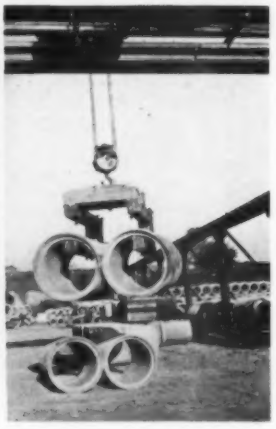
Interior view of pipe plant. Bins for aggregates to the left, pipe machine in center, and crane operator to the right

A factor of considerable importance in producing pipe of high quality is the method of curing. Great care is exercised in the treatment of the pipe before it is placed in yard storage. In the sum-

Upper left: Tractors and small trailer trucks used to haul large pipe around storage yard. Upper right: View of the plant and large storage yard in the background. Lower left: Tractor and semi-trailer for long distance hauling. Lower right: Electric traveling crane handling large pipe







mer the pipe are sprayed and placed for several days in a moisture-saturated atmosphere in the kilns, and in the winter the pipe are steam cured. An automatic stoker and high pressure boiler are used in the central heating plant which also provides steam for the pipe curing kilns.

Modern welding and wire bending equipment is employed for forming the steel cages for reinforced pipe. The plant has a machine shop completely equipped for repairs, maintenance and experimental work. Part of this equipment includes a 60-ton hydraulic pipe testing machine.

To meet practically any demand that may be made for its concrete tile and pipe products, the Illinois-Wisconsin Pipe and Tile Co. has a very large and complete stock available in the storage yard. Large forms and pipe are handled in the plant and in storage by overhead electric traveling cranes. Gasoline tractors and small trailers are used for "yarding" large pipe.

This company operates its own fleet of trucks for making deliveries and transporting materials. For long distance hauling, a tractor and semi-trailer with a load capacity of 13 tons is used. The various forms of highway and yard transportation are illustrated on page 84.

Uruguay Cement Plant

INFORMATION from South America indicates that plans are under way for a new cement plant in Uruguay. Incorporation papers have been issued for the Sociedad Anonima Nacional de Cementos with authorized capital of 2,500,000 pesos. Promotors of the new company are said to be the large Supervielle interests. According to the incorporation papers, products to be manufactured include portland cement, super cement, white cement, hydraulic lime and quick-lime.

Hawaii Cinder Block

KAUAI TERMINAL, LTD., merchandise department, is now producing concrete hollow tile with equipment having a capacity of 1000 tiles in an 8-hr. shift. The tile is made with volcanic cinders aggregates which results in a light but very strong product. An ample supply of volcanic cinders is available.

Big Ready-Mixed Job

GEO. T. MCLEAN CO., INC., Portsmouth, Va., was awarded a contract for $92,200 worth of ready-mixed concrete by the Public Contracts Division of the Labor Department for use by the Norfolk Navy Yard.

BUYERS' FREE SERVICE

RESEARCH SERVICE DEPARTMENT, *Rock Products*, 205 W. Wacker Drive, Chicago, Ill.
We are in the market for and would like to receive prices and literature on the items checked below:

....Admixtures
....Aerial Tramways
....Aggregates (Special)
....Agitators
....Air Compressors
....Air Separators
....Architectural Trimstone Molds
....Ash Receptacle Molds
....Ash & Refuse Handling Equipment
....Asphalt Mixing Plants
....Backdiggers
....Backfillers
....Bags
....Bagging Machines
....Balls (Grinding)
....Barges
....Batchers (Weighing)
....Bearings
....Belting (Conveyor & Elevator)
....Bins (Storage)
....Blasting Supplies
....Block Machines, Building
....Boats
....Brick Machines & Molds
....Buckets
....Building Tile Machines
....Bulk Cement Batching Plants
....Bulk Cement Storage Plants
....Bulldozers
....Bullscrapers
....Burial Vault Forms
....Calcining Equipment
....Calcium Chloride
....Cars (Industrial)
....Catch Basin Block Machines
....Cement Plants
....Cement Colors
....Cement Process
....Central Mixing Plants (Concrete)
....Chimney Block Machines & Molds
....Clarifiers
....Classifiers
....Coal Pulverizing Equipment
....Concentrators
....Concrete Mixers
....Concrete Paints & Coatings
....Concrete Waterproofing & Dampproofing
....Conveyors
....Conveyor Idlers and Rolls
....Coolers
....Corn Crib Block and Tile Machines
....Correcting Basins
....Cranes (Crawler & Locomotive)
....Crushers
....Crushing & Screening Plants (Portable)
....Culvert Pipe Machines & Molds (Concrete)
....Curing Equipment
....Curb Forms (Concrete)
....Dedusters
....Dehydrators
....Derricks
....Dewatering Equipment
....Dippers & Teeth
....Disintegrators
....Dragline Cableway Excavators
....Drain Tile Machines
....Dredges
....Dredge Pumps
....Drills (Rock)
....Drill Bits
....Drill Sharpening Machines
....Drill Steel
....Dryers
....Dust Collecting Systems
....Dust Precipitators
....Dust Recovery Plants
....Dynamite
....Electric Motors
....Electrostatic Separators
....Elevators
....Engineering Service (Consulting & Designing)
....Engines (Diesel, Gasoline, Steam)
....Feeders
....Fence Post Molds & Machines (Concrete)
....Floor Tile Machines (Concrete)
....Garbage Receptacle Molds (Concrete)
....Garden Furniture Molds (Concrete)
....Generators & Motor Generator Sets
....Greenhouse Bench Forms (Concrete)
....Guns (Hydraulic)
....Gutter Block Machines (Concrete)
....Hoists
....Hoppers
....Hose
....Hydrators (Lime)
....Joist & Slab Machines (Concrete)
....Kilns (Rotary, Shaft, Vertical)
....Laboratory Apparatus
....Laundry Tub Molds (Concrete)
....Light Post & Standard Forms
....Lime (Hydrated)
....Lime Handling Equipment
....Lime Plants
....Lime Putty Plants
....Loaders
....Locomotives
....Mills (Ball, Compartment, Emery, Hammer, Rod, Roll, Tube)
....Mortar Mixers
....Pallets (Steel, Wood)
....Pans, Grinding (Wet & Dry)
....Perforated Metal
....Pipe Molds and Machines (Concrete)
....Pipe
....Plaster Mixers
....Pontoons
....Pulverizers
....Pumps (Pulverized Material)
....Railway Equipment
....Rectifiers
....Recuperators
....Refractories
....Rewashers (Screw)
....Rock Wool Cupolas
....Roofing Tile Machines
....Sand Drags
....Sand & Gravel Plants
....Sand Lime Brick Machinery
....Sand Settling Tanks
....Scales
....Scrapers (Power Drag)
....Screens (Revolving, Vibrating, Etc.)
....Seal Rings
....Septic Tank Molds (Concrete)
....Sewer Pipe Machines (Concrete)
....Shale Planers
....Shovels (Power)
....Sidewalk Forms
....Sill Forms (Concrete)
....Silos (Storage)
....Silo Stave Machines
....Slakers (Rotary)
....Slurry Mixers
....Slurry Pumps
....Slurry Separators
....Slurry Thickeners
....Step Forms (Concrete)
....Tampers (Hand & Power)
....Tanks (Storage)
....Tractors
....Trucks (Agitator)
....Trucks (Dump)
....Trucks (Industrial)
....Trucks (Mixer Body)
....Unloaders
....Unloaders (Boat)
....Unloaders (Box Car)
....Wagons (Dump)
....Wall Forms & Machines (Concrete)
....Washers (Sand, Gravel & Stone)
....Welding & Cutting Equipment
....Well Curbing Machine & Molds (Concrete)
....Wire Cloth
....Wire (Copper, Iron & Steel)
....Wire Rope

Firm Name _____
Individual _____ *Title* _____
Address _____
City _____ *State* _____

News About People

William Faylor, for the past year manager of the Smethport plant of the General Crushed Stone Co., Easton, Penn., has resigned to become an official of the Superior Asphalt Co., Middleburg, Penn.

•

Charles M. Cadman has been made president of both Transit Concrete, Ltd., and Golden Gate-Atlas Materials Co., San Francisco, Calif., subsidiaries of Pacific Coast Aggregates, Inc., of the same city. Other officers of both companies are as follows: Carroll Stephens, vice-president and general manager; Orlo P Steele, assistant to general manager, and H. W. Senter, secretary-treasurer. W. S. Betts is assistant secretary and assistant treasurer of Transit Concrete, Ltd., and Maurice W. Griffin is assistant secretary of the Golden Gate-Atlas Materials Co.

•

W. A. Davis, formerly vice-president in charge of sales, Standard Portland Cement Co., Cleveland, Ohio, has been elected president of the company. He will continue to maintain headquarters in Cleveland.

•

Charles F. Greene has been made superintendent of the Carrs Station plant of Atlantic Refractories Co., Macon, Ga., according to an announcement by President W. P. Stevens. Mr. Greene is a ceramic engineer with long experience in the manufacture of refractories, and a graduate of Georgia Institute of Technology.

•

T. K. Holmes was elected vice-president of the Calaveras Cement Co., San Francisco, Calif., at the recent board of directors' meeting. Mr. Holmes succeeds G. B. Poore. J. Tedesco was appointed assistant treasurer and was re-named secretary of the company.

George M. Richardson was elected president of the National Portland Cement Co., Philadelphia, Penn., at the annual meeting. Other officers elected included: Fred B. Franks, vice-president and general manager; Eric Thune, vice-president; H. J. Larkin, assistant vice-president and assistant general manager; and Phillip Leidy, secretary. Mr. Richardson also was elected treasurer to fill the vacancy caused by the death of the late John B. Shibe, who was one of the owners of the Philadelphia Athletics ball team at the time of his death.

R. G. Sutherland formerly with the Lone Star Cement Co. Pennsylania division, Nazareth, Penn., has been made superintendent of the Alabama Division of the plants at Birmingham and Spocari, Ala.

Dean of Sand Industry

Edward M. Ayers, president and general manager of the Ayers Mineral Co., Zanesville, Ohio, recently celebrated his 54th year in business and his 50th wedding anniversary. Practically the whole industrial sand industry—in point of production—went to Zanesville to assist in the celebration.

On behalf of the National Industrial Sand Association, President Warsaw, on the evening of May 12, at their home in Zanesville, presented Mr. and Mrs. Ayers with the beautiful, engraved crystal vase, shown in the illustration herewith. The engravings were designed to present a pictorial record of some of the principal events in his life.

Following the reception at Mr. and Mrs. Ayers' home, they and their family were hosts to the entire convention at the Headley Inn, a famous stopping place in the days of horse-drawn stage coaches, where a delightful dinner and entertainment was enjoyed.

Mr. Ayers was a founder member of the National Industrial Sand Association, but that is a very recent event in his experiences as a sand producer and marketer. For many years he did his own selling and his personal knowledge of the glass, foundry and ceramic industries, which are his chief customers, is extensive indeed.

He is one of Zanesville's best known and most civic-minded citizens. The Art Institute, where the Association's meetings were held, was his gift to the city.

Left: Mr. and Mrs. Edward M. Ayers holding crystal vase presented by the National Industrial Sand Association. Center, above: A close-up of vase. Right: Dinner party given by Mr. Ayers to delegates

New MACHINERY & EQUIPMENT

Alloy Steel in the Cement Mill

By DAVID EVANS*

THE AUTHOR of this article feels that a better title would be "The Economy of Better Materials" for surely, if slowly, engineers realize that under modern conditions of keen competition the best materials obtainable are the cheapest in the long run. In addition to the extra life which better materials give, there is the avoidance of the costly and irritating loss of production through frequent shutdowns to replace worn parts that unexpectedly give out, and usually at the most inopportune time.

It will not be the purpose of this article to go into the history and development of alloy steel, but to accept the results which others have secured for us and to consider, briefly, their application to present needs and conditions. It is appropriate to remark, however, that the wonders of modern engineering depend more closely than is generally realized upon special qualities of the materials employed. Engineering science has progressed just so far as the properties of materials available would permit. Hence, each improvement in alloy steel has been immediately followed by advances in engineering practice.

About fifty years ago Sir Robert Hadfield discovered that steel containing from 11 to 13 percent of manganese possessed unusual properties of strength and ductility, in addition to being non-magnetic. It was one of those unusual events where the product, like Minerva, sprang "full panoplied" from its creators head and, as the inventor stated in one of his numerous treatises in 1926, except for certain improvements in the knowledge of its manufacture, manganese steel is the same today as it was when first discovered.

While it is a metal of undoubted value and has many varied applications, manganese steel has certain disadvantages which limit its use. It cannot be machined, except by grinding and, owing to its low yield point, has a tendency to stretch or "flow" under certain conditions of work. The application of heat destroys its wear resisting qualities and it cannot be re-worked in the field by any of the usual methods or with the equipment usually available.

*President, Chicago Steel Foundry Co., Chicago, Ill.

Co-incident with the discovery of manganese steel considerable work was being done with other alloys—nickel, chrome, tungsten, later with vanadium and still more recently with molybdenum. At first it was nickel alone, then with the addition of chromium and finally nickel-chrome-vanadium or nickel-chrome-molybdenum. The latter combination of alloys is the one most recently developed and constitutes the various grades of alloy steel in the range, now classified, as S. A. E. 3140 and 4100 series. The technical skill required to produce these grades with uniform and predetermined results is a study all by itself and those foundries that specialize on them are the ones that rank highest today in the alloy steel field.

Nickel-chrome-molybdenum steel castings of the 4100 series are sold under a number of trade names. It is almost imperative, from a commercial standpoint to give alloys trade names in order to identify a certain grade with a certain type of service to be performed. To try to describe a steel by simply saying nickel-chrome only results in confusion, because there are at least twenty-two grades of nickel-chrome steels designated by S. A. E. 3115 to 3450, and at least twelve grades of nickel - chromium, nickel - molybdenum and chrome-molybdenum, designated by S. A. E. numbers 4130 to 4820.

In and around cement mills the items that may be furnished in wear-resisting alloy steel of this character include dipper teeth, tooth points, bucket lips, conveyor screws, liners, drag chains, gears, worms, sheaves. sprockets, and the like.

The advantages of steel of this type, are (*a*) it is machinable and, therefore, permits more accurate assembly; (*b*) permits selective hardening. The wearing parts may be hardened to almost any desired degree while the machined parts may be left in their soft machinable state. (*c*) The elimination of unnecessary "dead" weight. Designs may usually be changed without disturbing any working dimensions and sufficient useless stock removed to more than pay for the added cost of the alloy and at the same time give a stronger and longer wearing part.

The newest field around cement mills for the use of alloy steel is in the grades running much higher in both chrome and nickel and known as heat-resisting alloys. While there are about thirty combinations of nickel-chrome steels recognized as standard grades, probably 90 percent of the heat-resisting alloys used are confined to about three grades —those running 26 to 28 percent chrome with 12 to 14 percent nickel, 25 percent nickel with 16 to 18 percent chrome and 35 percent nickel with 16 to 18 percent chrome. One foundry has in addition to a grade to operate at 1400 to 1500 deg. F. containing lower percentages of either nickel or chrome and a liberal silicon content. Silicon steel has long been used in Germany as a heat resisting alloy, with no other alloying element. It is better than carbon steel and much cheaper than chrome-nickel. There are also standard brands of heat-resisting alloy produced in this country that, in addition to the usual percentages of nickel and chrome, carry a high silicon content. The addition of silicon complements the nickel and chrome and produces an alloy of unusual tensile strength at high temperature.

Among the most general uses for these grades of steel are castings for cooling equipment, conveyor screws working at high temperatures, drag chains also working at high temperature, kiln ends, feed spouts, grids, etc., or any place where working temperatures exceed 1200 deg. F. and not over 2200 deg. F. for continuous operation.

The first cost of heat resisting alloys may be about ten times the cost of carbon steel, but the life is about fifty times that of carbon steel; which is, after all, real economy and brings us back to our original text—the economy of better materials.

Compressor Air Hose

THE MANHATTAN RUBBER MFG. DIVISION of Raybestos-Manhattan, Inc., Passaic, N. J., has designed and is now marketing an air drill hose, constructed with an inner tube of gas-oil-proof synthetic rubber, for use on air compressors and in other service where oil is present in the line. Oil as a solvent causes natural rubber to swell and to deteriorate rapidly, while the synthetic rubber will withstand the effects of oil and yet have all the qualities of ordinary rubber.

This recent development in air drill hose is constructed with two or three braids of strong, long staple cotton cord.

Between these are placed sheets of live rubber which vulcanization forces into the cord, forming one inseparable unit. It is claimed that this construction, with the addition of a heavy abrasion-resisting cover of black rubber, gives the hose great strength. It is available in all regular sizes from ¼-in. to 2-in.

Diesel Engines In Industry

By T. M. ROBIE*

EARLY DIESEL ENGINE development was in the heavy, slow speed units for stationary service, using high pressure air to blow the fuel into the cylinder. It was necessary to compress the air in the cylinder to about 500 p.s.i. in order to heat it sufficiently to ignite the entering fuel charge. For this reason compressed air for the injection of the fuel had to be at pressures of from 750 to 1000 p.s.i. in order to secure the proper atomization and penetration. Under these conditions, a three-stage air compressor, with its attendant troubles, was required, and the manufacturers turned to the development of airless or solid injection of fuel. Another early development was the semi-Diesel, in which the compression pressure did not go beyond 250 p.s.i. This engine required the use of a "hot plug" for the initial start.

Trend to Two-Cycle Engine

Another phase of development was the two-cycle and four-cycle principles of operation, but the trend today is toward the two-cycle. In the two-cycle engine, the burned gases are blown out at the end of each power stroke and the cylinder filled with fresh air for the compression stroke. At the end of the compression stroke, fuel is injected and, burning, develops pressure for the power stroke. Thus, there is a power stroke per cylinder every revolution in a two-cycle engine. The scavenging process is accomplished in any of several ways, the most common being by means of two sets of ports or openings in the bottom of the cylinder wall. The exhaust ports lead the burned gases out of the cylinder and the air intake ports provide means of entrance of the scavenging air. This air is compressed either in the engine crankcase or in a suitable scavenging pump. Proper port design is really the secret of the success of the two-cycle design. The two-cycle design is more simple due to the elimination of the intake and exhaust valves and the necessary gear to operate them, and there is a more uniform turning effort secured by a power stroke every revolution where the four-cycle design has a power impulse every other revolution.

The Diesel engine has operated on a most efficient cycle from the start, but it has been possible to considerably lower the specific fuel consumptions so that now it is not unusual to find comparatively small units developing a hp. hr. on less than 0.40 lb. of fuel. This corresponds to a thermal efficiency of 33.5 percent, a figure seldom equalled even in the large central station steam turbine plants.

This efficiency of the small units has an important bearing on the use of Diesels in industry. As plants increase in size, additional Diesel units may be purchased without affecting the operating economy. There is also an added advantage in having more than one unit in the average industrial plant because the load is not always constant, and by having two or more units they may be fitted to the load requirements so that each operates under the most efficient conditions.

Diesel Engine Precautions

Precautions necessary to give a dependable, long lived, economical plant are summed up briefly:

1. Fit the engines to the load.
2. Provide air filters to remove abrasive dust.
3. Keep fuel and lubricating oil clean.
4. Use a closed cooling water system to prevent scale formation.
5. Provide pyrometers to check engine operation.

A few of the many applications of a Diesel as related to the lime industry are worthy of mention. Diesels are widely used in shovel and dragline operation. A 2-cu. yd. shovel operating in rock would require a Diesel of approximately 150 to 175 hp., and under these conditions would consume about 5 gal. of fuel per hour. From the pit, the material could be transported to the crushing plant by either a Diesel truck or a Diesel-powered locomotive. A 10-ton locomotive would require about an 80 hp. Diesel.

The crushing plant might well be operated with a heavy duty stationary Diesel either with a direct drive to the mill machinery or a combination direct and electric drive, or a full electric drive. Definite recommendations would be dependent on the particular plant layout.

Finished material from the plant must be loaded into railroad cars or barges, and here again Diesel operated equipment is available for economical operation. A 25-ton locomotive crane could be used to advantage. This would be powered with a 100 to 125 hp. Diesel and would normally burn about 2 gal. of fuel per hour.

While a freight train cannot yet be pulled out with a Diesel locomotive, as these so far have been limited to passenger service, still if a river is handy the material can be shipped with a Diesel-propelled towboat.

The following costs will be of interest as a basis of rough comparison using certain assumed unit costs and operating efficiencies:

COST COMPARISON 300 DAYS AT 10 HOURS PER DAY

	Cost Per H. P.
Diesel Cost	
Fuel at 5c per gal. Consumption 0.40 lb. per b.hp. per hr.	$ 8.30
Purchased Power Cost	
Motor efficiency 80 percent. Cost per kw. hr. 2c	56.00
Steam Cost	
Coal at $5.00 per ton. Coal per hp. hr. 4.0 lb.	30.00

The above are fuel cost only, and to them should be added cost of labor, maintenance, lubricating oil and miscellaneous supplies, which will vary depending on the particular installation.

It is of interest to check the comparative distribution of Diesels in the various industries. A recent issue of *Diesel Progress* shows that the rock products industry is well up the list with 250,000 hp. of Diesel installed capacity out of a total of 11,450,000 hp. for all industries, but the percentage should really be larger when it is considered how well suited the Diesel is for this service.

ATLAS POWDER CO., Wilmington, Del., has announced a new type Manasite blasting cap. The new cap contains an initiating material chemically known as Hexanitromannite which is said to be less sensitive to impact and friction than the detonating compounds commonly used, thereby substantially increasing the margin of safety in the event of accidental mishandling.

JUAN MINETTI E HIJOS, Cordoba, Argentina, has given the Allis-Chalmers Manufacturing Co. another large order for cement machinery aggregating approximately $237,000. The equipment covered by this order, when completed, will be shipped to the purchaser's present plant at Mendoza, Argentina.

*Abstract of an address before the recent convention of the National Lime Association. Mr. Robie is manager, Diesel sales, Fairbanks, Morse & Co., Chicago, Ill.

· NEWS · OF · THE · MONTH ·

Improvements

DEWEY PORTLAND CEMENT CO., Dewey, Okla., plant has resumed operation at full capacity. During the winter shutdown all the employes were kept on the payroll and many improvements installed, including new rock drying equipment, and new finish grinding equipment with dust collectors.

New Plant

SOUTH MILWAUKEE, WIS., will have a new sand and gravel plant, according to reports which state that operations already have started. A name has not yet been selected and the legal incorporation papers have not yet been completed. Seven acres of land have been purchased at the present north limits of Fifteenth Avenue from the Schneider family, and the top soil has already been removed from an acre of the land, which is said to have a good grade of gravel from 20 to 30-ft. deep. Machinery for removing and washing gravel is now in service.

New Line

LEHIGH PORTLAND CEMENT CO., Allentown, Penn., has purchased the plant and business of the Mikolite Co., Kansas City, Mo. Mikolite is the trade name of a heat expanded vermiculite product largely used for insulation and as an aggregate in sound absorbing plaster and lightweight concrete. A similar product is sold under other trade names. The raw material for the Kansas City plant comes from Wyoming.

Dust Problem

NEW YORK STATE CRUSHED STONE ASSOCIATION met at Syracuse, N. Y., April 21. Twenty-six members and guests were present. Among the guests were A. T. Goldbeck, engineering director, and J. R. Boyd, administrative director, of the National Crushed Stone Association.

Among the major items discussed was the industry's dust control problem, which is the first of several problems common to the industry being handled by R. R. Litehiser, engineering director of the State Association.

Receivership

YAKIMA SAND AND GRAVEL CO., Yakima, Wash., has been placed in receivership with Ronald Hull, attorney, as temporary receiver. James Humes, who is seeking to collect $628.25 from the company, claims that the company is insolvent or in danger of insolvency and alleges that the company will receive $12,000 from the government in connection with a contract for supplying materials on the Roza project. It is necessary that these assets be impounded for the benefit of creditors, he alleges.

Dredge Operation

W. C. SCOTT SAND AND GRAVEL CO., Macon, Ga., has just started operation of a new dredging plant in the southern part of the city, using two 6-in. Georgia Iron Works dredges, one as a booster. A stationary gravity screen is used for the main separation and a cone for sand settling and dewatering.

Production Resumed

NORTHWESTERN STATES PORTLAND CEMENT CO., Mason City, Ia., resumed production early in May, after a longer than usual shutdown.

ALPHA PORTLAND CEMENT CO., Cementon, N. Y., plant resumed operation May 23. Production was resumed at Martins Creek, Penn., plant late in April.

ASH GROVE LIME AND PORTLAND CEMENT CO., Chanute, Kan., plant resumed production May 1 after a shutdown from March 9.

SUPERIOR PORTLAND CEMENT, INC., Concrete, Wash., plant resumed production May 6, having been down since December.

YOSEMITE PORTLAND CEMENT CO., Merced, Calif., resumed a full production schedule after several months' crippled operation because of flood damage to the quarry-connecting railroad.

WOLVERINE PORTLAND CEMENT CO., Quincy, Mich., plant resumed production in the clinker-grinding department late in April.

NORTH AMERICAN CEMENT CORP., Alsen, N. Y., plant resumed operation early in April after a shutdown from November 20 last.

PETOSKEY PORTLAND CEMENT CO., Petoskey, Mich., resumed production May 7. Seventy-five men, or about one-half the full force, were employed all winter.

MONARCH PORTLAND CEMENT CO., Humbolt, Kan., resumed April 20 after a shutdown from January 20.

CONSOLIDATED CEMENT CORP., Fredonia, Kan., plant resumed production the middle of April.

PEERLESS CEMENT CORP., Port Huron, Mich., plant resumed production early in April to fill a contract for cement for the Blue Water International Bridge.

Reorganization

GLENCOE LIME & CEMENT CO., St. Louis, Mo., plan for liquidation and reorganization has been approved by the U. S. District Court. Under the plan, the company's real estate containing limestone deposits and lime plant in Glen Park, Jefferson County, Mo., would be sold to a syndicate represented by Fred W. Goessling for $25,000, and the Glencoe (St. Louis County) real estate with limestone deposits and lime plant would be sold for $40,000 to the St. Louis Realty & Securities Co. Both properties would be operated by two new concerns.

Creditors with claims which occurred prior to filing of the second reorganization petition on October 13, 1937, would be paid from proceeds of certain assets, such as cash on hand, notes and accounts receivable and real estate not mortgaged. Creditors with claims caused after the filing of the petition would be paid in full.

Stockholders would be given an option of buying 49 percent of the common stock in a new company, which would be formed by the purchasers of the Glen Park property. Preferred stockholders would have the initial option to the new stock, and common stockholders would be entitled to stock not purchased by the preferred stockholders.

Sample NLRB Decision

STANDARD LIME AND STONE CO., Baltimore, Md., which operates quarries and plants at Martinsburg, W. Va., has appealed to the U. S. Circuit Court from a ruling of the National Labor Relations Board which is astonishing to say the least. The company had a strike in 1935, attended by considerable violence. Eight of the company's former employes are in the state penitentiary on their pleas of guilty to dynamiting the electric power lines to the plant. Six others were sent to jail on their pleas of guilty to conspiracy in the dynamiting. The eight in the pen are exempt, but the other six who are now free again must be reemployed by the company under the NLRB ruling. The union involved is the Quarry Workers International, formerly A. F. of L., but recently a convert to C. I. O.

Consolidation

ARIZONA SAND AND ROCK CO. has purchased the C. P. Munger Rock Co. of Phoenix, Ariz. C. P. Munger, former proprietor, has retired from the sand and gravel industry to devote his entire time to his citrus orchard business.

Ready-Mixed Activities

OHIO READY-MIXED CONCRETE ASSOCIATION is the name of a new state group recently organized at Columbus, Ohio. Stephan Stepanian, vice-president of the Arrow Sand & Gravel Co., was elected president; Henry Beckley, Beckley and Myers Co., Springfield, Ohio, vice-president; C. E. Ehle, Cleveland Builders Supply Co., Cleveland, treasurer, and Claude L. Clark, Columbus, Ohio, secretary. Directors include, in addition to President Stepanian and Vice-President Beckley: C. E. Kuhlman, Kuhlman Builders Supply Co., Toledo; M. J. Byrnes, Superior Ready-Mixed Concrete Co., St. Bernard; William Goldie, Goff-Kirby Co., Cleveland; R. O. Davies, Kallmerton & Baer, Mansfield; P. Milliron, East Liverpool; Henry H. Bayerl, Portsmouth Mixed Concrete Co., Portsmouth; A. A. Hilkert, Botzum Brothers Co., Akron.

The new association has established offices in the Majestic Bldg., Columbus, jointly with the Ohio Sand and Gravel Association, of which Mr. Clark is also secretary. It will coöperate fully with the National Ready-Mixed Concrete Association.

PORTSMOUTH MIXED CONCRETE, INC., Portsmouth, Ohio, has established a branch plant in Ironton, Ohio, which will be located on the property of the Standard Slag Co. Sam Frowine is president of the corporation and Ralph Frowine is vice-president. Henry Bayerl, secretary-treasurer, will be in charge of the Ironton plant.

KOENIG COAL AND SUPPLY CO., Detroit, Mich., sand and gravel producers, are reported to have erected modern facilities for the production of ready-mixed concrete.

A SITE has been obtained on the Baltimore & Ohio Railroad right-of-way in Loraine, Ohio, by a Mansfield, Ohio company for the purpose of establishing a ready-mixed concrete plant.

Award Upheld

STANDARD TRAP ROCK CO., which built a plant at Piermont, Rockland County, N. Y., that never operated, and the Sparkhill Realty Corp. have been awarded $1,969,039.97 for condemnation of their property in the Palisades, 164 acres along the Hudson River. This award was recently upheld by the Appellate Division of the State Supreme Court in the third time the case was brought before the court. In previous actions the Appellate Division and the Court of Appeals had sent the case back to the Court of Claims for new trials. The case had been in the courts for several years and was a notable one because of the array of quarry experts who testified for and against the quarry company as to its appraisal of the value. The state condemned the property for inclusion in the Palisades Park and to prevent defacement of the Hudson River scenery. Otho M. Graves was a leading expert for the state and his good friend, A. L. Worthen, for the Standard Trap Rock Co., both past-presidents of the National Crushed Stone Association. Their appraisals were several million dollars apart.

Concrete Products Enterprises

MARIETTA CONCRETE CO., Marietta, Ohio, will extend its operations to Shelbyville, Ky. Henry Long, who has been Kentucky representative of the company, and Ray Weller, Louisville, Ky., have erected a concrete structure 50-x 150-ft., which will be owned by them as partners, but will be operated as a unit of the Ohio company.

CLINGBUILT CONCRETE PRODUCTS & SEPTIC TANK CO., Seattle, Wash., has added new equipment and will widen the scope of its activities to include all concrete products, according to A. W. Clingenpeel, owner.

KRIS NIELSEN, cement block manufacturer of Rochester, Minn., is erecting a new factory three stories high, 40-x150-ft., which will be made of cement blocks, stone and reinforced concrete. Gravity will be the governing principle in handling the material in the plant, which is being built on the side of a hill. Sand will be dumped into a bin on the third floor, then it will be drawn from the bin into the mixer on the second floor, and from the mixer the concrete will be chuted to the block machine on the first floor.

THE DES MOINES CONCRETE PRODUCTS CO., Des Moines, Iowa, is the name of a new plant located at Sixty-third Street and Coon River, south of West Des Moines. Nate Hannaford, formerly operator of a sand and gravel pit is the owner.

BOR CEMENT PRODUCTS CO., Hollywood, Fla., is the name of a new cement block manufacturing company located on McKinley Street at the Florida East Coast Railroad tracks. A special "wet cement block" is to be manufactured.

STATE SAND & GRAVEL CO., Indianapolis, Ind., has decided to erect a Brooks-Taylor lime putty plant. W. L. Heston is general manager of the company. In addition to this development, the company also has taken over the Allied Ready-Mixed Concrete Co. of the same city.

TVA Crushing Plant

TENNESSEE VALLEY AUTHORITY, Copper Hill, Tenn., has installed a stone crushing plant to supply aggregates for Hiawassee Dam, newest of the TVA chain. Capacity of the plant will be 400 tons hourly, and it is expected that one million tons will be produced in two years.

Improvements

LAWRENCE STONE AND GRAVEL CO., Columbia, S. C., is building a new plant.

WESTON & BROOKS, Columbia, S. C., also is making improvements in its stone plant.

STOCKBRIDGE STONE CO. Stockbridge, Ga., is erecting a new plant.

SOUTHERN STATES PORTLAND CEMENT CO., Rockmart, Ga., has a new office building, and has replaced 25-cycle motors in the mill with new 60-cycle motors.

GENERAL CRUSHED STONE CO., Easton, Penn., has purchased the black-top mixing plant of A. L. Blades, Hornell, N. Y.

AMERICAN LIMESTONE QUARRY CORP., Wingdale, N. Y., was recently organized to produce ground and pulverized limestone.

Sand and Gravel Enterprises

SMALLFIELD SAND AND GRAVEL CO., on the Kent-Ravenna Road, near Ravenna, Ohio, is active this spring. Concrete block are also manufactured.

CASCADE COUNTY, Montana has established a new gravel pit on county land two miles south of the city limits on the Ayrshire road. The WPA is coöperating on the project.

COLONIAL SAND AND GRAVEL CO., INC., New York, N. Y., has leased for a long term from the Henry Phipps estate the vacant East River frontage between 53rd and 54th Sts. formerly leased to the Materials Delivery Corp. The Colonial Sand & Stone Co., Inc., has leased space for executive quarters in the RCA Building, New York City, for occupancy July 1.

DURLAND SAND CO. Wyoming, Penn., has been very active this spring in supplying sand and gravel to road projects. Including a fleet of trucks, the plant investment is said to be $60,000.

CITY SAND & GRAVEL CO., Madison, Wis., has been taken over by Conklin & Sons Co., of the same city, according to an announcement by President J. B. Conklin. The company will also continue to handle Janesville, Wis., sand and gravel.

EVANSTON, ILL., refused to buy the Doetsch gravel pit owned by John Doetsch for $84,000, but it is believed that negotiations may be reopened.

Obituaries

SAMUEL W. LAUB, Sr., chief chemist of the Ormrod, Penn., plant of the Lehigh Portland Cement Co., for the past 30 years, died April 26 at his home in Egypt, Penn. Mr. Laub was 51 years of age.

•

EDWARD R. HART, president and treasurer of the Edward R. Hart Co., Canton, Ohio, asbestos products firm, died recently at the age of 54. Mr. Hart, a resident of Canton for 22 years, was a representative of the Johns-Manville Co., until he organized his own company in 1921.

•

WILSON DANIEL ROTH, superintendent of the Pennsylvania plant No. 6 of the Penn-Dixie Cement Co., Bath, Penn., died recently. He was 61 years old, and had served as superintendent of this plant for 25 years. Mr. Roth was a veteran employe with 30 years' service.

•

H. L. MERRICK, president and founder of Merrick Scale Manufacturing Co., Passaic, N. J., died on May 2, at the age of 65. Mr. Merrick is said to be the inventor of the first American conveyor scale. He was a graduate of Stevens Institute of Technology. At one time he was chief draftsman and later shop superintendent of the Robins Conveying Belt Co., Passaic, N. J.

•

CHARLES H. SHAW, the past three years Philadelphia office manager for the Worthington Pump and Machinery Corp., died on April 15. He was associated with the Worthington organization for 18 years.

•

SILAS A. TUCHER, manager of the Chicago branch of the Mechanical Rubber Goods division, The Manhattan Rubber Manufacturing Division, Raybestos-Manhattan, Inc., died recently at the age of 51. Mr. Tucker had been with Manhattan for more than 25 years, and for a number of years had been Chicago branch manager.

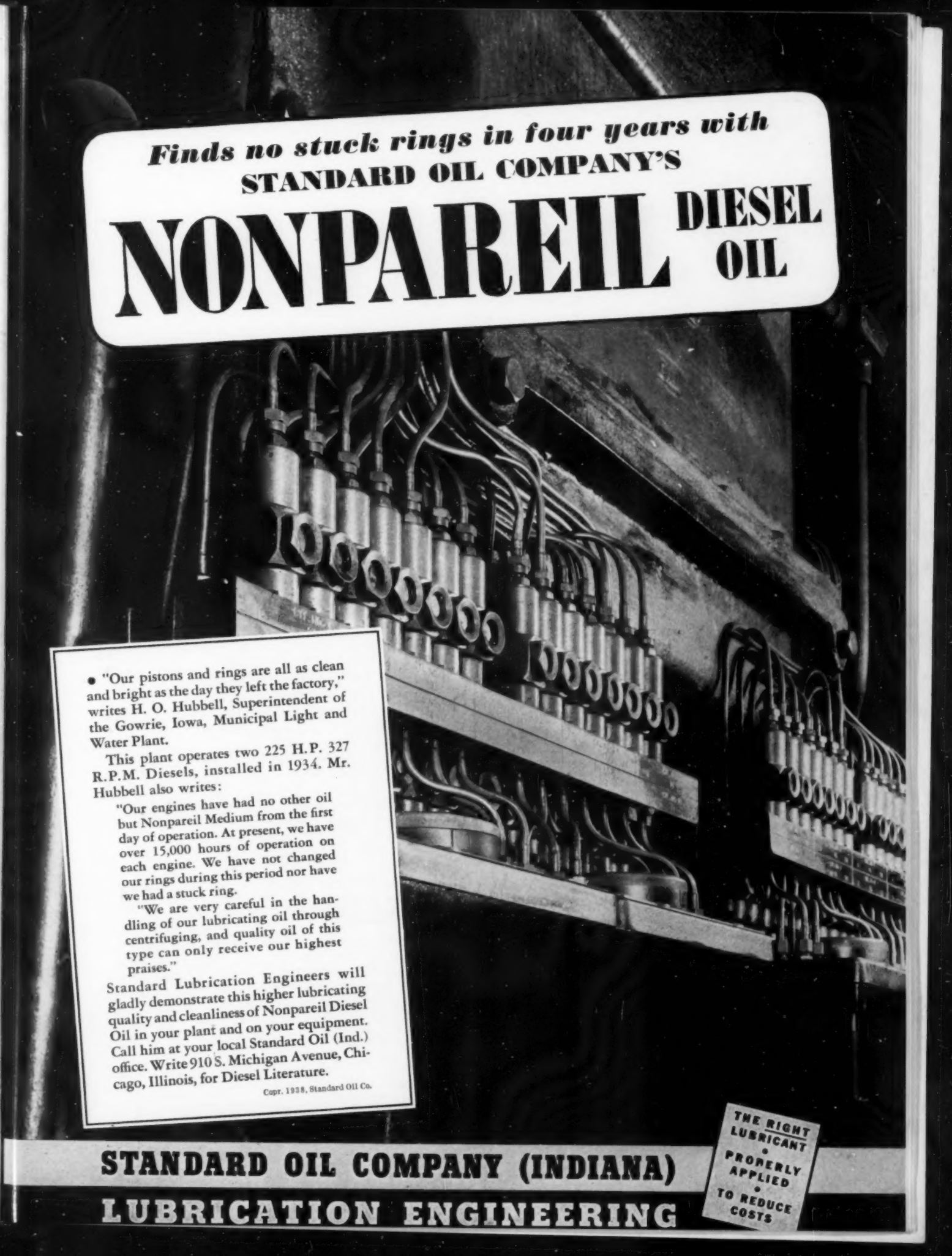
•

CLARENCE E. COOK, general manager of mechanical goods, The B. F. Goodrich Co., Akron, Ohio, died on April 16. He was 58 at the time of his death, and started his career with the company as an office boy.

•

W. M. PURVES, general sales manager, Dodge Division, Chrysler Corp., Detroit, Mich., died suddenly in Los Angeles.

MANILA, PHILIPPINE ISLANDS, imported cement from the United States in April, said to be the first time in 30 years. Japanese cement has been imported for years to meet demands that the two local government-owned plants have been unable to meet.



Finds no stuck rings in four years with

STANDARD OIL COMPANY'S

NONPAREIL DIESEL OIL

• "Our pistons and rings are all as clean and bright as the day they left the factory," writes H. O. Hubbell, Superintendent of the Gowrie, Iowa, Municipal Light and Water Plant.

This plant operates two 225 H.P. 327 R.P.M. Diesels, installed in 1934. Mr. Hubbell also writes:

> "Our engines have had no other oil but Nonpareil Medium from the first day of operation. At present, we have over 15,000 hours of operation on each engine. We have not changed our rings during this period nor have we had a stuck ring.
>
> "We are very careful in the handling of our lubricating oil through centrifuging, and quality oil of this type can only receive our highest praises."

Standard Lubrication Engineers will gladly demonstrate this higher lubricating quality and cleanliness of Nonpareil Diesel Oil in your plant and on your equipment. Call him at your local Standard Oil (Ind.) office. Write 910 S. Michigan Avenue, Chicago, Illinois, for Diesel Literature.

STANDARD OIL COMPANY (INDIANA)

LUBRICATION ENGINEERING

THE RIGHT LUBRICANT • PROPERLY APPLIED • TO REDUCE COSTS

Black-Top Plant

SOUTHWEST STONE CO., Dallas, Texas, has recently completed construction of a cold mix asphalt plant at its Chico, Texas, quarry. At present three sizes of stone (½-in. minus, 1¼-in. minus and 2½-in. minus) are being mixed with asphalt in a pug mill for various types of surfacing. Stone is taken direct from the kilns by truck to the asphalt plant hopper, where it is elevated to bins over the pug mill. Capacity of the plant is about 100 tons hourly of cold mix asphalt. A somewhat similar plant was installed by the company at Stringtown, Okla., two years ago.

Trucks have replaced quarry cars at these plants and the plant at Knippo, Texas, in delivery store to the crushing plants. The trucks are Macks and Whites and the bodies carry seven tons of stone to the load.

Wins Tax Suit

ALEXANDRIA GRAVEL CO., INC., Alexandria, La., which has been sued for a federal income tax deficiency of $1031.99 won a decision in its favor from the Fifth United States Circuit Court of Appeals. The sand and gravel company, according to reports of the trial, had hired District Judge J. Hugo Dore, then a state legislator, as a salesman on commission to obtain sand and gravel contracts from the Louisiana Highway Commission. The contracts were obtained on competitive bids, and a commission of 10 percent was paid Judge Dore. The United States Board of Tax Appeals in June, 1937, had upheld a tax assessment on $8361, the total commissions paid to Judge Dore, declaring that nothing could be paid to him because his contract under which he was to receive 10 percent for sales he made was one of "personal influence with the state highway department" and was void and unenforceable "as being against public policy." However, the Appeals Court held that "there is no statute in Louisiana which prohibits members of the legislature from dealing with administrative bodies."

Cement Pavement Yardage

AWARDS of concrete pavement for April, 1938, have been announced by the Portland Cement Association as follows:

Type of Construction	Sq. yds. awarded during April, 1938	Total sq. yds. for year to date, April 30, 1938
Roads	3,039,280	7,247,330
Streets	1,218,931	3,067,892
Alleys	25,602	134,568
Total	4,283,813	10,449,790

Sand-Lime Bricks Production and Shipment

THE FOLLOWING DATA are compiled from reports received direct from producers of sand-lime brick located in the various parts of the United States. They may be considered representative of the industry.

Eight active sand-lime brick plants reporting for April and ten for March, statistics for which were published in May.

Average Price for April

	Plant Price	Delivered Price
Mishawaka, Ind.	$10.25	....
St. Louis Park, Minn.	9.50	11.00
Grand Rapids, Mich.	11.00	14.00
Milwaukee, Wis.	10.00	12.50
Detroit, Mich.	....	16.00
Sabewaing, Mich.	10.00	....
Syracuse, N. Y.	14.00	16.00 C/L 20.00 L/C

Statistics for March and April

	March‡	April†
Production	1,345,335	1,007,228
Shipment (rail)	92,786	170,000
Shipment (truck)	1,495,243	1,191,664
Stock on hand	1,653,427	747,238
Unfilled orders	1,329,000	1,070,000

‡Ten plants reporting; incomplete, four not reporting unfilled orders and one not reporting stock on hand.

†Eight plants reporting; incomplete five not reporting unfilled orders and two not reporting stock on hand.

THE INDUSTRY

Manufacturers

Pangborn Corp., Hagerstown, Md., has announced the removal of their New England offices to 175 State Street, Springfield, Mass. J. H. Connolly, formerly district sales engineer in the Detroit office, will be in charge.

Barber-Greene Co., Aurora, Ill., has appointed E. F. Lamprey to its sales organization with headquarters at 84 Rogers Street, Cambridge, Mass. W. B. Holder is eastern sales manager in charge of the Boston office. Mr. Lamprey was formerly with the Barber-Greene organization. The following distributors have been named by the company: A. R. Amos, Jr., Commercial Trust Building, Philadelphia, Penn.; Columbia Equipment Co., Portland, Ore.; W. T. Jones Co., Dooly Building, Salt Lake City, representing the company in the sale of mining, smelting and other equipment; The Lund Machinery Co., continuing to handle the sand and gravel equipment; A. E. Hunt, 1115 Burnaby St., Vancouver, B. C., Canada, and J. Shuman Hower, 85 North Genesee St., Utica, New York.

Mack-International Motor Truck Corp., Long Island City, N. Y., reports the election of E. F. Staniford as president of the company, succeeding the late W. R. Edson. Mr. Staniford also was elected vice-president of the parent company, Mack Trucks, Inc. R. D. Hilty has been elected vice-president of the Mack-International Motor Truck Corp., in charge of export sales.

Koehring Co., Milwaukee, Wis., has appointed Contractors Equipment Corp., 1215 S.E. Grand Ave., Portland, Ore., as distributor in the Oregon territory. The personnel of the new distributing company includes the following: O. C. Jessup, John W. Miles, Robert D. Vial, and Alfred A. Carlson.

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Penn., has appointed Andrew H. Phelps as general manager of purchases and traffic, succeeding T. J. Pace, who has become assistant to vice-president. Mr. Phelps joined the Westinghouse organization on January 1, 1937, coming from the McGraw-Hill Publishing Co., where he served as sales manager and director of public relations. R. F. Frenger has been made sales manager of the switchgear division.

Connecticut Blower Co., Hartford, Conn., has announced through General Manager Charles H. Keeney that Edward F. Klick, Rochester, N. Y., has become special sales engineer for New York State.

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has appointed William Arthur as Philadelphia District Office Manager to suceed the late J. E. Wray. Mr. Arthur, who is widely known for his engineering contributions to electric traction since 1931, had been the company's special representative for railway traction and mercury arc rectifiers in the East.

Taylor-Wharton Iron & Steel Co., Easton, Penn., has announced the appointment of G. V. Wood as Pacific Coast Manager with offices in the Balfour Building, San Francisco, Calif. For the past three and a half years, Mr. Wood has been managing director of Alluvial Dredges, Ltd., London, England.

Gar Wood Industries, Inc., Detroit, Mich., has inaugurated a profit-sharing plan whereby employes will receive 20 percent of all declared dividends. The profit-sharing plan applies principally to factory employes and excludes salaried employes receiving over a certain stipulated sum.

General Electric Co., Schenectady, N. Y., has formed a new Standards Department which will work with various local, national and international associations and agencies interested in standards and codes and will also promote the development of standards for use in the company's engineering and manufacturing department. L. F. Adams will serve as manager and assistant to Vice-President E. O. Shreve. Associated with Mr. Adams will be E. B. Paxton, E. R. Anderson, H. W. Samson, and H. W. Robb.

The Joseph F. Seaman Gold Medal has been awarded to Frederick Ayers Lorenz, Jr., vice-president of the American Steel Foundries Co., Chicago

New Incorporations

Cinder Block, Inc., Roanoke, W. Va., has purchased the assets of the former Stone-Tile and Supply Co. of that city and reorganized under the new name with a maximum capital stock of $125,000. It will continue to deal in concrete products and ceramic ware. M. W. Ferguson is president of the new company.

Concrete Products Corp., Hopkinsville, Ky., has been formed by R. C. White and Eli D. Mitchell with a capital stock of $10,000.

Concrete Products, Inc., St. Petersburg, Fla., has been incorporated, with 50 shares of no par value stock, by E. R. Jahna, W. K. McVicar and Emmett Donnelly, who are listed as directors of the company.

Crescent Quarry & Construction Corp., Kirkwood, Mo., capital stock listed as $10,000. Incorporators are A. F. Meyer and Sylvan G. Powell.

Detroit Graphite Co., incorporated in Delaware, is listed as having capital in Oklahoma of $1200. Geo. M. Green, 735 First National Bldg., Oklahoma City, Okla., is the service agent.

Egyptian Asphalt Products Co., Inc., 113½ East Main St., DuQuoin, Ill., has been incorporated with 250 shares of $100 par value common stock. Incorporators are J. C. Louis, L. Garbi and Marion C. Cook, who is also the correspondent. The company will deal in all kinds of paving and building materials.

Fresco Lime Corp., Manhattan, N. Y., has been incorporated to deal in lime products. John H. Levy, 120 E. 41st St., New York, N. Y., is the correspondent.

Hurleyville Sand and Gravel Co., Hurleyvill, N. Y., has filed certificate of incorporation listing as temporary directors Samuel J. Pugatz, Mrs. Pearl Pugatz and Miss Gail Jacobson.

McKee City Sand & Gravel Corp., McKee City, N. J., is listed as having been incorporated for $10,000. Frank Passerelli is the agent.

Modern Concrete Products, Inc., Miami, Fla., incorporated by R. H. Ward, B. Rodringer and S. C. Lohmeyer, to deal in concrete, has a capitalization of 50 shares, no par value.

Natural Stone and Slate Co., Oklahoma City, Okla., has been granted a charter which was delivered to Mrs. A. C. Robinson, 214 N. W. 7th, Oklahoma City. The charter permits a capitalization of $10,000 in stocks. Incorporators are A. C. Robinson, Gordon T. Schaul and F. Ivonne Robinson.

Salem Concrete Pipe and Construction Co., Salem, Ore., Hugh P. Ford, Howard A. Hall and Russell F. Fretz have incorporated the company for the purpose of manufacturing and selling concrete and other pipe. Capital stock is $5000.

Syracuse Ready-Mix Concrete Co., Inc., Syracuse, N. Y., has been organized by W. J. and W. E. McClusky, City Bank Bldg., Syracuse, N. Y., to deal in cement. Capital stock is $10,000.

"If salesmen call me a 'wise guy', it's just because I have found that an 'Oh, yeah?!' attitude is a quick and easy way to discourage 'em. And I am too darned busy to spend al! day arguing! Besides, I never like to make up my mind while the salesman is present.

"But there's one place where a sales approach *can* get in some good licks . . . right in the pages of ROCK PRODUCTS. For one thing, I remove that 'wise guy' mask when I pick up this paper, because here is where I get the progressive ideas about my business . . . ideas suggested by editors who know the rock products' and concrete products' industries from alpha to izzard.

"I read the advertisements, too, because I know that any advertiser in a publication that belongs to The Associated Business Papers isn't getting editorial 'puffs', so he must have something *real* to offer.

"ROCK PRODUCTS is worth its subscription price many times over because it serves as a business handbook *and* as a buying guide."

How to MODERNIZE

YOUR DUST ARRESTING EQUIPMENT —AT SMALL COST

View shows an old dust arrester case rebuilt with new Sly cloth bag filter parts. Sufficient space was available to place the bags in rows three tiers high. Each bag has 22 square feet of cloth and is held under proper tension by springs.

You can modernize your old dust collector by installing new Sly flat cloth bag filter parts . . . at a cost only a little higher than rebuilding your equipment with original parts, and at a much lower cost than new equipment. The Sly cloth filter was designed with this purpose in view.

If you are expanding operations you can have additional filtering capacity with such change over. In rebuilding we can always exceed present filtering capacity for handling more air, or reducing the ratio of air to cloth and lowering the resistance to the flow of air, without using all of the present case. The balance of the case is converted into a classifier or settling chamber.

When we furnish new parts the shaker device mechanism includes a gear head motor with base, support and housing (not shown). The shaker mechanism is designed to flex, beat and shake each bag over 200 times per minute.

By connecting the dust pipe or pipes to this classifier section much of the heavy *abrasive* material entering the filter will be deposited in this section, allowing only the finest dust to reach the cloth bags.

You also save on operating cost by rebuilding because the new shaker mechanism thoroughly cleans the bags, thereby keeping the static resistance of the filter to a minimum which reduces the power required at the exhaust fans.

In these times when every cost is put under a magnifying glass, scores of plants are finding a Sly change over means a better and even larger dust collecting system without buying all new equipment.

A few minutes to investigate this plan will easily mean substantial savings for you. Your inquiry will receive prompt attention.

Cut shows a new Sly filter for collecting dust created by filling cement silos. With Sly parts you can make your old dust arrester equally modern.

THE W. W. SLY MANUFACTURING COMPANY

Blast Cleaning Equipment, Tumbling Mills
Dust Control Equipment for Every Industrial Purpose

4700 Train Ave., Cleveland, Ohio

BRANCH OFFICES IN PRINCIPAL CITIES

Classified Directory of Advertisers in this Issue of ROCK PRODUCTS

For alphabetical index, see page 118

Acetylene
Weldit Acetylene Co.

Admixtures (Aggregate)
Calcium Chloride Ass'n.

Aerial Tramways
American Cable Co.
Broderick & Bascom Rope Co.
Leschen, A., & Sons Rope Co.

Aftercoolers (Air)
Chicago Pneumatic Tool Co.

Aggregates (Special)
Calcium Chloride Ass'n.
Mica Crystal Co.
Tamms Silica Co.

Agitators
Allis-Chalmers Mfg. Co.
Hetherington & Berner, Inc.
Neff & Fry Co.
Smidth, F. L., & Co.
Traylor Engineering & Mfg. Co.

Air Compressors
Allis-Chalmers Mfg. Co.
Chicago Pneumatic Tool Co.
Fuller Co.
Gardner-Denver Co.
Nordberg Mfg. Co.
F. L. Smidth & Co.
Traylor Engineering & Mfg. Co.

Air Filters
Blaw-Knox Co.
Connecticut Blower Co.
Draco Corp.
Fuller Co.
Sly, W. W. Mfg. Co.
Western Precipitation Co.

Air Heaters
American Blower Corp:

Air Separators
Babcock & Wilcox Co.
Blaw-Knox Co.
Combustion Engr. Corp.
Gruendler Crusher & Pulv. Co.
Link-Belt Co.
Raymond Pulv. Div.
Sly, W. W. Mfg. Co.
Smidth, F. L., & Co.
Sturtevant Mill Co.
Universal Road Machy. Co.
Western Precipitation Co.
Williams Patent Crusher & Pulv. Co.

Airveyors
Fuller Co.

Alloys (Metal)
Chicago Steel Foundry Co.
Frog, Switch & Mfg. Co.

Ash & Refuse Handling Equipt.
Allen-Sherman Hoff Co.
Haiss, Geo., Mfg. Co.
Hetherinton & Berner, Inc.
Link-Belt Co.
Palmer-Bee Co.
Robins Conveying Belt Co.

Asphalt Heaters
Easton Car & Const. Co.

Asphalt Mixer Regulators
Hetherington & Berner, Inc.

Asphalt Mixing Plants
Hetherington & Berner, Inc.
Traylor Engineering & Mfg. Co.

Axles
Eagle Iron Works

Babbitt Metal
Allis-Chalmers Mfg. Co.
Dixie Machy. Mfg. Co.
Ryerson, Jos. T., & Son, Inc.

Backdiggers
Bay City Shovels, Inc.
Lima Locomotive Wks., Inc. (Shovel & Crane Div.)
Link-Belt Co.

Backfillers
Austin-Western Road Machy. Co.
Bucyrus-Erie Co.
Lima Locomotive Wks., Inc. (Shovel & Crane Div.)
Link-Belt Co.
Marion Steam Shovel Co.

Bag Cleaning Machines
Link-Belt Co.
Stearns Mfg. Co.

Bagging Machines
Smidth, F. L., & Co.

Balers or Bundling Machines (Sack)
Besser Mfg. Co.
Stearns Mfg. Co.

Balls (Grinding)
Allis-Chalmers Mfg. Co.
Babcock & Wilcox Co.
Carnegie-Illinois Steel Corp. (U. S. Steel Corp. Subsi.)
Smidth, F. L., & Co.
Traylor Engineering & Mfg. Co.

Barges
Chicago Bridge & Iron Co.
Eagle Iron Works

Batchers, Measuring Volume
Besser Mfg. Co.
Fuller Company
Heltzel Steel Form & Iron Co.
Jaeger Machine Co.
Neff & Fry Co.
Smith, T. L., Co.
Stearns Mfg. Co.

Bearing Metals
Allis-Chalmers Mfg. Co.

Bearings (Anti-Friction)
Eagle Iron Works
Hetherington & Berner, Inc.
Link-Belt Co.
Palmer-Bee Co.
Robins Conveying Belt Co.
Ryerson, Jos. T., & Sons, Inc.
Standard Pressed Steel Co.
Timken Roller Bearing Co.

Bearings (Ball)
New Departure Div. of General Motors Corp.

Bearings (Roller and Tapered Roller)
Timken Roller Bearing Co.

Bearings (Thrust)
Palmer-Bee Co.
Timken Roller Bearing Co.

Belting (Elevator and Conveyor)
Austin-Western Road Machy. Co.
Bacon, Earle C., Co.
Barber-Greene Co.
Haiss, Geo., Mfg. Co.
Link-Belt Co.
Robins Conveying Belt Co.
Thermoid Rubber Co.

Belting (Transmission)
Bacon, Earle C., Co.
Haiss, Geo., Mfg. Co.
Link-Belt Co.
Smidth, F. L., & Co.
Thermoid Rubber Co.

Belting (V Type)
Allis-Chalmers Mfg. Co.
Link-Belt Co.
Thermoid Rubber Co.

Belt Cutting Machines
Detroit Belt Lacer Co.

Belt Fasteners or Hooks
Detroit Belt Lacer Co.
Flexible Steel Lacing Co.
Robins Conveying Belt Co.

Belt Idlers
Link Belt Co.
Robins Conveying Belt Co.
Smith Engineering Wks.

Belt Lacing
Detroit Belt Lacer Co.
Flexible Steel Lacing Co.

Belt Lacing Machines
Detroit Belt Lacer Co.

Belt Tighteners
Robins Conveying Belt Co.

Belt Trippers
Bacon, Earle Co., Inc.
Link-Belt Co.
Robins Conveying Belt Co.

Bin Gates
Allen-Sherman-Hoff Co.
Allis-Chalmers Mfg. Co.
Bacon, Earle C., Co.
Besser Mfg. Co.
Fuller Co.
Geo. Haiss Mfg. Co., Inc.
Heltzel Steel Form & Iron Co.
Hendrick Mfg. Co.
Industrial Brownhoist Corp.
Link-Belt Co.
McLanahan & Stone Corp.
Neff & Fry Co.
Robins Conveying Belt Co.
Smith Engineering Works
Traylor Engineering & Mfg. Co.
Universal Road Machy. Co.

Bin Indicators
Bin-Dicator Co.
Fuller Co.

Bins (Storage)
Allen-Sherman-Hoff Co.
Austin-Western Road Machy. Co.
Besser Mfg. Co.
Blaw-Knox Co.
Eagle Iron Works
Heltzel Steel Form & Iron Co.
Hendrick Mfg. Co.
Hetherington & Berner, Inc.
Link-Belt Co.
McLanahan & Stone Corp.
Neff & Fry Co.
Pioneer Engineering Wks., Inc.
Robins Conveying Belt Co.
Smidth, F. L., & Co.
Traylor Engineering & Mfg. Co.
Universal Crusher Co.
Universal Road Machy. Co.

Blasting Cups
Atlas Powder Co.
Hercules Powder Co.

Blasting Cap Crimpers
Ensign-Bickford Co.

Blasting Machines
Atlas Powder Co.
Hercules Powder Co.

Blasting Supplies
Atlas Powder Co.
Ensign-Bickford Co.
Hercules Powder Co.

Block Machines, Building
Anchor Concrete Machinery Co.
Besser Mfg. Co.
Multiplex Concrete Machy Co.
R & L Concrete Machy. Co.
Stearns Mfg. Co.

Blocks (Pillow)
Allis-Chalmers Mfg. Co.
Link-Belt Co
Palmer-Bee Co.
Robins Conveying Belt Co.
Standard Pressed Steel Co.
Timken Roller Bearing Co.

Blocks (Sheave)
Haiss, Geo., Mfg. Co.
Link-Belt Co.
Pioneer Engineering Wks., Inc.
Sauerman Bros.

Blowers
Allis-Chalmers Mfg. Co.
Connecticut Blower Co.
Sly, W. W., Mfg. Co.

Boats (Self-Unloading)
Link-Belt Co.
Robins Conveying Belt Co.

Boilers
Babcock & Wilcox Co.
Combustion Engineering Corp.

Bolts
Standard Pressed Steel Co.

Brick Machines
Besser Mfg. Co.
Multiplex Concrete Mach. Co.
R & L Concrete Machinery Co.
Stearns Mfg. Co.

Buckets (Clamshell, Grab, Orange Peel, etc.)
Blaw-Knox Co.
Bucyrus-Erie Co.
Geo. Haiss Mfg. Co., Inc.
Hayward Company
Industrial Brownhoist Corp.
Jaeger Machine Co.
Link-Belt Co.
Robins Conveying Belt Co.

Buckets (Dragline and Slackline)
Austin-Western Road Machy. Co.
Bay City Shovels, Inc.
Besser Mfg. Co.
Blaw-Knox Co.
Bucyrus-Erie Co.
Gruendler Crusher & Pulv. Co.
Hayward Company
Hendrick Mfg. Co.
Link-Belt Co.
Pioneer Engineering Wks., Inc.
Sauerman Bros., Inc.

Buckets (Dredge & Excavator)
Bucyrus-Erie Co.
Haiss, Geo., Mfg. Co.
Hayward Co.

Buckets (Elevator and Conveyor)
Bacon, Earle C., Co.
Haiss, Geo., Mfg. Co.
Hendrick Mfg. Co.
Industrial Brownhoist Corp.
Jaeger Machine Co.
Lewistown Foundry & Mach. Co.
Link-Belt Co.
McLanahan & Stone Corp.
Palmer-Bee Co.
Pioneer Engineering Wks., Inc.
Robins Conveying Belt Co.
Smith Engr. Wks.

Buckets (Electric Heated, Weighing)
Easton Car & Const. Co.

Building Tile Machines
Besser Mfg. Co.
Multiplex Concrete Machy. Co.
R & L Concrete Machy. Co.
Stearns Mfg. Co.

Bulk Cement Batching Plant
Heltzel Steel Form & Iron Co.

Bulk Cement Storage Plants
Heltzel Steel Form & Iron Co.

Bulldozers
Blaw-Knox Co.
Bucyrus-Erie Co.

Bullscrapers
Bucyrus-Erie Co.

Bushings
Eagle Iron Wks.
Link-Belt Co.

Cableways
American Cable Co. Inc.
Blaw-Knox Co.
Broderick & Bascom Rope Co (Yellow Strand)
Leschen, A., & Sons Rope Co.
Link-Belt Co.
Sauerman Bros.

Calcining Equipment
Allis-Chalmers Mfg. Co.
Blaw-Knox Co.
Calcium Chloride Ass'n.
Smidth, F. L., & Co.
Traylor Engineering & Mfg. Co.

Calcium Chloride
Calcium Chloride Ass'n.

Capstans
Dake Engine Co.
Link-Belt Co.
Robins Conveying Belt Co.

Cars (Block, Dump, Industrial, Etc.)
Austin-Western Road Machy. Co.
Besser Mfg. Co.
Carnegie-Illinois Steel Corp. (U. S. Steel Corp. Subsi.)
Eagle Iron Works
Easton Car & Const. Co.
Link-Belt Co.
Multiplex Concrete Mach. Co.
Stearns Mfg. Co.
Traylor Engineering & Mfg. Co.

Classified Directory—*Continued*

Car Dumps
Eagle Iron Wks.
Link-Belt Co.

Car Pullers & Movers
Appleton-Atlas Car Mover Corp.
Link-Belt Co.
Robins Conveying Belt Co.

Car Wheels
Eagle Iron Wks.
Link-Belt Co.

Car Wrenches
Appleton-Atlas Car Mover Corp.

Castings
Allis-Chalmers Mfg. Co.
Babcock & Wilcox Co.
Bacon, Earle C., Co.
Blaw-Knox Co.
Chicago Steel Foundry Co.
Dake Engine Co.
Dixie Machinery Mfg. Co.
Eagle Iron Works (Grey Iron)
Frog, Switch & Mfg. Co.
Hetherington & Berner, Inc.
Lima Locomotive Wks. (Shovel & Crane Div.)
Link-Belt Co.
McLanahan & Stone Corp.
Robins Conveying Belt Co.
Smidth, F. L., & Co.
Timken Roller Bearing Co
Traylor Engineering & Mfg. Co.

Cement Plants (Contractor)
Allis-Chalmers Mfg. Co.
Gruendler Crusher & Pulv. Co.
Neff & Fry Co.
F. L. Smidth & Co.
Traylor Engineering & Mfg. Co.

Cement Colors
Mepham, Geo. S., Corp.
Tamms Silica Co.

Cement Process
Cement Process Corp.

Cement Pumps
Fuller Co.
Smidth, F. L., & Co.

Central Mixing Plants (Concrete)
Blaw Knox Co.
Heltzel Steel Form & Iron Co.
Jaeger Machine Co.
Neff & Fry Co.

Chain (Dredge and Steam Shovel)
Bucyrus-Erie Co.
Link-Belt Co.
Palmer-Bee Co.

Chain (Elevating and Conveying)
Bacon, Earle C., Co.
Gruendler Crusher & Pulv. Co.
Haiss, Geo., Mfg. Co.
Link-Belt Co.
Neff & Fry Co.
Palmer-Bee Co.

Chimney Block Machines and Molds
Besser Mfg. Co.

Chutes (Bin, Truck, Concrete, Etc.)
Allis-Chalmers Mfg. Co.
Austin-Western Road Machy. Co.
Earl C. Bacon, Inc.
Blaw-Knox Co.
Eagle Iron Works
Gruendler Crusher & Pulv. Co.
Haiss, Geo., Mfg. Co.
Hendrick Mfg. Co.
Jaeger Machine Co.
Link-Belt Co.
McLanahan & Stone Corp.
Neff & Fry Co.
Pioneer Engineering Wks., Inc.
Robins Conveying Belt Co.
Ross Screen & Feeder Co.
Smidth, F. L., & Co.
Traylor Engineering & Mfg. Co.

Chute Liners
Bacon, Earle C., Inc.
Haiss, Geo., Mfg. Co.
Hendrick Mfg. Co.
Link-Belt Co.
McLanahan & Stone Corp.
Robins Conveying Belt Co.
Smidth, F. L., & Co.

Circuit Breakers
Allis-Chalmers Mfg. Co.

Circuit Testers
Hercules Powder Co.

Clarifiers
Link-Belt Co.

Classifiers
Allis-Chalmers Mfg. Co.
Blaw-Knox Co.
Eagle Iron Works
Lewistown Fdry. & Mach. Co.
Link-Belt Co.
Nordberg Manufacturing Co.
Pioneer Engineering Wks., Inc.
Raymond Pulverizer Division
Sly, W. W., Mfg. Co.
Smidth, F. L., & Co.
Traylor Engineering & Mfg. Co.
Universal Vibr. Screen Co.
Western Precipitation Co.
Williams Patent Crusher & Pulv. Co.

Clutches
Allis-Chalmers Mfg. Co.
Link-Belt Co.

Coal Pulverizing Equipment
Allis-Chalmers Mfg. Co.
Austin-Western Road Machy. Co.
Babcock & Wilcox Co.
Combustion Engr. Corp.
Gruendler Crusher & Pulv. Co.
Link-Belt Co.
Pennsylvania Crusher Co.
Raymond Pulverizer Division
F. L. Smidth & Co.
Traylor Engr. & Mfg. Co.
Universal Crusher Co.
Williams Patent Crusher & Pulv. Co.

Concrete Mixers
Anchor Concrete Machy. Co.
Besser Mfg. Co.
Blaw-Knox Co.
Gruendler Crusher & Pulv. Co.
Jaeger Machine Co.
Multiplex Concrete Machy. Co.
Smith, T. L., Co.
Stearns Mfg. Co.

Concrete Paints & Coatings
Tamms Silica Co.

Concrete Waterproofing & Dampproofing
Tamms Silica Co.

Controllers (Electric)
Allis-Chalmers Mfg. Co.

Converters (Electric)
Allis-Chalmers Mfg. Co.

Conveyors (Apron)
Allis-Chalmers Mfg. Co.
Barber-Greene Co.
Gruendler Crusher & Pulv. Co.
Link-Belt Co.
Palmer-Bee Co.
Robins Conveying Belt Co.
Traylor Engr. & Mfg. Co.

Conveyors (Belt)
Allen-Sherman-Hoff Co.
Allis-Chalmers Mfg. Co.
Austin-Western Road Machy. Co.
Earle C. Bacon
Barber-Greene Co.
Besser Mfg. Co.
Dracco Corp.
Fuller Company
Gruendler Crusher & Pulv. Co.
Geo. Haiss Mfg. Co., Inc.
Hendrick Mfg. Co.
Industrial Brownhoist Corp.
Lewistown Fdy. & Mach. Co
Link-Belt Co.
McLanahan & Stone Corp.
Multiplex Concrete Mach. Co.
New Holland Machine Co.
Palmer-Bee Co.
Pioneer Engineering Wks., Inc.
Robins Conveying Belt Co.
F. L. Smidth & Co.
Smith Engineering Works
Stearns Mfg. Co.
Sturtevant Mill Co.
Traylor Engineering & Mfg. Co.
Universal Crusher Co.
Universal Road Machy. Co.
Williams Patent Crusher & Pulv. Co.

Conveyors (Hydro Vacuum)
Allen-Sherman Hoff Co.

Conveyors (Monorail)
Palmer-Bee Co.

Conveyors (Overhead)
Palmer-Bee Co.

Conveyors (Pan)
Allis-Chalmers Mfg. Co.
Link-Belt Co.

Conveyors (Pneumatic)
Dracco Corp.
Fuller Company
Gruendler Crusher & Pulv. Co.
Raymond Pulverizer Division

Conveyors (Screw)
Besser Mfg. Co.
Eagle Iron Works
Gruendler Crusher & Pulv. Co.
Link-Belt Co.
Palmer-Bee Co.

Conveyors (Trolley)
Link-Belt Co.
Palmer-Bee Co.

Conveyors (Vibrating)
Allis-Chalmers Mfg. Co.
Link-Belt Co.
Smidth, F. L., & Co.

Conveyor Idlers & Rolls
Austin-Western Road Machy. Co.
Bacon, Earle C., Inc.
Barber-Greene Co.
Gruendler Crusher & Pulv. Co.
Haiss, Geo., Mfg. Co.
Link-Belt Co.
Palmer-Bee Co.
Pioneer Engineering Wks., Inc.
Robins Conveying Belt Co.
Smidth, F. L., & Co.

Coolers
Allis-Chalmers Mfg. Co.
Blaw-Knox Co.
Link-Belt Co.
Smidth, F. L., & Co.
Traylor Engineering & Mfg. Co.

Correcting Basins
F. L. Smidth & Co.

Couplings (Flexible and Shaft)
Allis-Chalmers Mfg. Co.
Farrel-Birmingham, Inc.
Link-Belt Co.
Palmer-Bee Co.
Robins Conveying Belt Co.
Standard Pressed Steel Co.

Cranes (Diesel Electric Steam, Etc.)
Austin-Western Road Machy. Co.
Bay City Shovels, Inc.
Bucyrus-Erie Co.
Industrial Brownhoist Corp.
Lima Locomotive Wks., Inc. (Shovel & Crane Div.)
Link-Belt Co.
Marion Steam Shovel Co.
Northwest Engineering Co.
Palmer-Bee Co.
Universal Crusher Co.

Cranes (Overhead Traveling Electric)
Industrial Brownhoist Corp.
Northern Engineering Wks.
Palmer-Bee Co.

Cranes (Tractor)
Austin-Western Road Machy. Co.
Bay City Shovels, Inc.
Bucyrus-Erie Co.
Lima Locomotive Wks., Inc. (Shovel & Crane Div.)
Link-Belt Co.

Cranes (Truck)
Bay City Shovels, Inc.

Crawler Attachments
Allis-Chalmers Mfg. Co.
Bay City Shovels, Inc.
Link-Belt Co.

Crawling Tractor Excavators
Austin-Western Road Machy. Co.
Link-Belt Co.

Crusher Parts
Allis-Chalmers Mfg. Co.
American Pulverizer Co.
Bacon, Earle C., Co.
Dixie Machinery Mfg. Co.
Eagle Iron Works
Frog, Switch & Mfg. Co.
Gruendler Crusher & Pulv. Co.
McLanahan & Stone Corp.
Pennsylvania Crusher Co.
Pioneer Engineering Wks., Inc.
Traylor Engr. & Mfg. Co.
Universal Crusher Co.

Crushers (Hammer)
Allis-Chalmers Mfg. Co.
American Pulv. Co.
Austin-Western Road Machy. Co.
Brooks Equipment & Mfg. Co.
Carnegie-Illinois Steel Corp. (U. S. Steel Corp. Subsi.)
Dixie Machy. Mfg. Co.
Gruendler Crusher & Pulv. Co.
Sturtevant Mill Co.
Universal Crusher Co.
Williams Patent Crusher & Pulv. Co.

Crushers (Jaw and Gyratory)
Allis-Chalmers Mfg. Co.
Austin-Western Road Machy. Co.
Earle C. Bacon, Inc.
Dixie Machinery Mfg. Co.
Gruendler Crusher & Pulv. Co.
Lewistown Fdy. & Mach. Co. (Jaw)
McLanahan & Stone Corp.
New Holland Machine Co.
Nordberg Mfg. Co.
Pennsylvania Crusher Co.
Pioneer Engineering Wks., Inc.
Smith Engineering Works
Traylor Engineering & Mfg. Co.
Universal Crusher Co.
Universal Road Machy. Co.
Williams Patent Crusher & Pulv. Co.

Crushers (Laboratory)
Allis-Chalmers Mfg. Co.
American Pulverizer Co.
Bacon, Earle C., Co.
Dixie Machinery Mfg. Co.
Gruendler Crusher & Pulv. Co.
Pennsylvania Crusher Co.
Sturtevant Mill Co.
Traylor Engineering & Mfg. Co.
Williams Patent Crusher & Pulv. Co.

Crushers (Primary Breakers)
Allis-Chalmers Mfg. Co.
Smith Engr. Wks.
Traylor Engr. & Mfg. Co.
Williams Patent Crusher & Pulv. Co.

Crushers (Reduction)
Allis-Chalmers Mfg. Co.
Austin-Western Road Machy. Co.
Bacon, Earle C., Inc.
Smith Engr. Wks.
Traylor Engr. & Mfg. Co.

Crushers (Ring)
American Pulverizer Co.
Dixie Machinery Mfg. Co.
Gruendler Crusher & Pulv. Co.
Williams Patent Crusher & Pulv. Co.

Crushers (Roll)
Allis-Chalmers Mfg. Co.
American Pulverizer Co.
Austin-Western Road Machy. Co.
Babcock & Wilcox Co.
Bacon, Earle C., Co.
Besser Mfg. Co.
Brooks Equipment & Mfg. Co.
Eagle Iron Works
Gruendler Crusher & Pulv. Co.
Link-Belt Co.
McLanahan & Stone Corp.
New Holland Machine Co.
Pennsylvania Crusher Co.
Pioneer Engineering Wks., Inc.
Robins Conveying Belt Co.
Smith Engineering Works
Sturtevant Mill o.
Traylor Engineering & Mfg. Co.
Universal Crusher Co.
Williams Patent Crusher & Pulv. Co.

Crushing and Screening Plants (Portable)
Allis-Chalmers Mfg. Co.
American Pulverizer Co.
Austin-Western Road Machy. Co.
Bacon, Earle C., Co.
Barber-Greene Co.
Blaw-Knox Co.
Dixie Machinery Mfg. Co.
Eagle Iron Works
Gruendler Crusher & Pulv. Co.
Heltzel Steel Form & Iron Co.
Link-Belt Co.
Pennsylvania Crusher Co.
Pioneer Engineering Wks., Inc.
Smith Engineering Works
Traylor Engineering & Mfg. Co.
Universal Crusher Co.
Williams Patent Crusher & Pulv. Co.

Curing Racks
Besser Mfg. Co.
Multiplex Concrete Machy. Co.
Stearns Mfg. Co.

Dedusters
Blaw-Knox Co.
Western Precipitation Co.

Dehydrators
Pioneer Engineering Wks., Inc.

Derricks
Hayward Company

Detonators
Atlas Powder Co.
Ensign-Bickford Co.
Hercules Powder Co.

Classified Directory—*Continued*

Dewatering Machines
Allis-Chalmers Mfg. Co.
Eagle Iron Works
Jaeger Machine Co.
Link-Belt Co.
Morris Machine Works

Diaphragms (Rubber)
Jaeger Machine Co.

Dippers & Teeth (Dredge & Shovel
Bucyrus-Erie Co.
Frog, Switch & Mfg. Co.
Link-Belt Co.
Marion Steam Shovel Co.

Disentegrators
Smidth, F. L., & Co.

Ditchers
Barber-Greene Co.
Bucyrus-Erie Co.
Marion Steam Shovel Co.

Dragline Cableway Excavators
American Cable Co.
Austin-Western Road Machy. Co.
Bay City Shovels, Inc.
Blaw-Knox Co.
Bucyrus-Erie Co.
Lima Locomotive Wks., Inc. (Shovel & Crane Div.)
Link-Belt Co.
Marion Steam Shovel Co.
Northwest Engineering Co.
Sauerman Bros., Inc.

Dredges
Bay City Shovels, Inc.
Bucyrus-Erie Co.
Eagle Iron Works
Hayward Co.
Hetherington & Berner, Inc. (Complete Steel)
Link-Belt Co.
Marion Steam Shovel Co.
Morris Machine Works

Dredge Cutter Heads & Ladders
Eagle Iron Wks.
Hetherington & Berner, Inc.

Dredge Hulls
Eagle Iron Wks.

Dredging Sleeves
Hetherington & Berner, Inc.
Thermoid Rubber Co.

Drills (Blast Hole)
Bucyrus-Erie Co.
Chicago Pneumatic Tool Co.
Gardner-Denver Co.

Drills (Hand Hammer)
Chicago Pneumatic Tool Co.
Gardner-Denver Co.

Drills (Rock)
Bucyrus-Erie Co.
Chicago Pneumatic Tool Co.
Gardner-Denver Co.
Timken Roller Bearing Co.

Drills (Well)
Bucyrus-Erie Co.

Drill Bits
Bucyrus-Erie Co.
Chicago Pneumatic Tool Co.
Timken Roller Bearing Co.

Drill Sharpening Machines
Bucyrus-Erie Co.
Gardner-Denver Co.

Drill Steel
Chicago Pneumatic Tool Co.
Gardner-Denver Co.

Drilling
Chicago Pneumatic Tool Co.

Drilling Accessories
Bucyrus-Erie Co.
Chicago Pneumatic Tool Co.
Gardner-Denver Co.
Timken Roller Bearing Co.

Drives (Belt, Chain and Rope)
Allis-Chalmers Mfg. Co.
Bacon, Earle C., Co.
Link-Belt Co.
Smidth, F. L., & Co.

Drives (Short Center)
Allis-Chalmers Mfg. Co.
Earle C. Bacon, Inc.
Link-Belt Co.
Smidth, F. L., & Co.

Drives (Worm)
Link-Belt Co.

Dryers
Allis-Chalmers Mfg. Co.
Babcock & Wilcox Co.
Blaw-Knox Co.
Combustion Engineering Corp.
Gruendler Crusher & Pulv. Co.
Hetherington & Berner, Inc.
Lewistown Foundry & Mach. Co.
Link-Belt Co.
McLanahan & Stone Corp.
Raymond Pulverizer Division
Smidth, F. L., & Co.
Traylor Engineering & Mfg. Co.
Tyler, W. S., Co.
Western Precipitation Co.
Williams Patent Crusher & Pulv. Co.

Dust Arrestors
Connecticut Blower Co.

Dust Collecting Systems
Allen Sherman Hoff Co.
Allis-Chalmers Mfg. Co.
American Blower Corp.
Blaw Knox Co.
Connecticut Blower Co.
Dracco Corp.
Hendrick Mfg. Co.
Raymond Pulverizer Division
Sly, W. W., Mfg. Co.
Smidth, F. L., & Co.
Western Precipitation Co.

Dust Conveying Systems
Allen-Sherman-Hoff Co.
Blaw-Knox Co.
Connecticut Blower Co.
Dracco Corp.
Fuller Company
Sly, W. W., Mfg. Co.
Western Precipitation Co.

Dust Collector Bags
Blaw-Knox Co.
Sly, W. W., Mfg. Co.

Dust Precipitators
Western Precipitation Co.

Dust Recovery Plants
Sly, W. W., Mfg. Co.
Western Precipitation Co.

Dynamite
Atlas Powder Co.
Hercules Powder Co.

Electric Motors
Allis-Chalmers Mfg. Co.

Electric Motor Starters
Allis-Chalmers Mfg. Co.

Elevators
Allen-Sherman-Hoff Co.
Allis-Chalmers Mfg. Co.
Austin-Western Road Machy. Co.
Bacon, Earle C., Co.
Barber-Greene Co.
Besser Mfg. Co.
Dracco Corp.
Eagle Iron Works
Fuller Company
Gruendler Crusher & Pulv. Co.
Haiss, Geo., Mfg. Co.
Hendrick Mfg. Co.
Industrial Brownhoist Corp.
Jaeger Machine Co.
Lewistown Foundry & Mach. Co.
Link-Belt Co.
McLanahan & Stone Corp.
Multiplex Concrete Mach. Co.
Neff & Fry Co.
New Holland Machine Co.
Palmer-Bee Co.
Pioneer Engineering Wks., Inc.
Robins Conveying Belt Co.
Smidth, F. L., & Co.
Smith Engineering Works
Sturtevant Mill Co.
Traylor Engineering & Mfg. Co.
Universal Crusher Co.
Universal Road Machy. Co.
Williams Patent Crusher & Pulv. Co.

Engineers
Allis-Chalmers Mfg. Co.
Bacon, Earle C., Co.
Blaw-Knox Co.
Fuller Co.
Gruendler Crusher & Pulv. Co.
Hetherington & Berner, Inc.
Link-Belt Co.
McLanahan & Stone Corp.
Morris Machine Works
Neff & Fry Co.
Productive Equipment Corp.
Robins Conveying Belt Co.
F. L. Smidth & Co.
Standard Oil Co. (Ind.)
Sturtevant Mill Co.
Traylor Engineering & Mfg. Co.
Williams Patent Crusher & Pulv. Co.

Classified Directory—*Continued*

Engines (Diesel, Gasoline, Kerosene and Oil)
Allis-Chalmers Mfg. Co.
Chicago Pneumatic Tool Co.
National Supply Co.
New Holland Machine Co.
Nordberg Mfg. Co.

Engines (Natural Gas)
Allis-Chalmers Mfg. Co.

Engines (Steam)
Allis-Chalmers Mfg. Co.
Dake Engine Co.
Morris Machine Works
Nordberg Mfg. Co.

Exhauster
Combustion Engineering Co.
Raymond Pulverizer Division

Explosives
Atlas Powder Co.
Hercules Powder Co.

Fans (Exhaust & Ventilating)
American Blower Corp.
Blaw-Knox Co.
Connecticut Blower Co.
Gruendler Crusher & Pulv. Co.
Sly, W. W., Mfg. Co.
Smidth, F. L., & Co.

Feeders
Allis-Chalmers Mfg. Co.
Babcock & Wilcox Co.
Barle C Bacon, Inc.
Barber-Greene Co.
Besser Mfg. Co.
Blaw-Knox Co.
Fuller Co.
Gruendler Crusher & Pulv. Co.
Hetherington & Berner, Inc.
Link-Belt Co.
Pennsylvania Crusher Co.
Pioneer Engineering Wks., Inc.
Robins Conveying Belt Co.
Ross Screen & Feeder Co.
Smidth, F. L., & Co.
Smith Engr. Wks.
Stearns Mfg. Co.
Traylor Engineering & Mfg. Co.
Universal Crusher Co.
Universal Road Machy. Co.

Filter Cloth
Tyler, W. S., Co.

Floor Sweeping Systems (Hydro Vacuum)
Allen-Sherman Hoff Co.

Forges
Gardner-Denver Co.

Forgings
Allis-Chalmers Mfg. Co.
Bacon, Earle C., Co.

Fuels (Diesel)
Texas Co.

Fuses (Detonating and Safety)
Atlas Powder Co.
Ensign-Bickford Co.
Hercules Powder Co.

Fuse Cutters
Ensign-Bickford Co.

Fuse Lighters
Ensign-Bickford Co.

Galvanometers
Hercules Powder Co.

Gasoline
Gulf Refining Co.
Standard Oil Co. (Ind.)
Texas Company

Gears
Allis-Chalmers Mfg. Co.
Bacon, Earle C., Co.
Farrel-Birmingham Co., Inc.
Frog, Switch & Mfg. Co.
Haiss, Geo., Mfg. Co.
Link-Belt Co.
Palmer-Bee Co.
Robins Conveying Belt Co.
Traylor Engineering & Mfg. Co.

Generators & Motor Generator Sets
Allis-Chalmers Mfg. Co.
National Supply Co.
Nordberg Mfg. Co.

Glass Sand Equipment
Lewistown Fdry. & Mach. Co.

Goggles
Weldit Acetylene Co.

Grapples
Blaw Knox Co.
Bucyrus-Erie Co.
Hayward Co.

Grease
Bacon, Earle C., Co.
Gulf Refining Co.
Standard Oil Co. (Ind.)
Texas Company

Grease Cups
Link-Belt Co.
Robins Conveying Belt Co.

Guards (Lamp)
Flexible Steel Lacing Co.

Guards (Machinery)
Harrington & King Perforating Co.
Tyler, W. S., Co.

Guns (Hydraulic)
Hetherington & Berner, Inc.
Morris Machine Works

Gypsum Plants
Gruendler Crusher & Pulv. Co.
Neff Fry Co.
Traylor Engr. & Mfg. Co.

Heaters (Bitumen)
Easton Car & Const. Co.

Hoists (Chain, Electric, Portable, Skip, Etc.)
Allis-Chalmers Mfg. Co.
Besser Mfg. Co.
Chicago Pneumatic Tool Co.
Commercial Shearing & Stamping Co.
Dake Engine Co.
Eagle Iron Works
Gardner-Denver Co.
Gruendler Crusher & Pulv. Co.
Hetherington & Berner, Inc.
Jaeger Machine Co.
Link-Belt Co.
McLanahan & Stone Corp.
Nordberg Mfg. Co.
Northern Engineering Wks.
Northwest Engineering Co.
Pioneer Engineering Wks., Inc.
Palmer-Bee Co.
Robins Conveying Belt Co.
Sauerman Bros., Inc.
Smith Engr. Wks.
Stearns Mfg. Co.
Traylor Engineering & Mfg. Co.
Universal Road Machy. Co.

Hoppers
Austin-Western Road Machy. Co.
Besser Mfg. Co.
Blaw-Knox Co.
Gruendler Crusher & Pulv. Co.
Heltzel Steel Form & Iron Co.
Hendrick Mfg. Co.
Jaeger Machine Co.
Link-Belt Co.
Neff Fry Co.
Pioneer Engineering Wks., Inc.
Robins Conveying Belt Co.
Traylor Engineering & Mfg. Co.
Universal Road Machy. Co.

Hose (Water, Steam, Air Drill, Pneumatic, Sand Suction and Discharge)
Chicago Pneumatic Tool Co.
Dixie Machinery Mfg. Co.
Hetherington & Berner, Inc.
Jaeger Machine Co.
Morris Machine Works
Thermoid Rubber Co.

Hose Clamps
Chicago Pneumatic Tool Co.

Hose Couplings
Chicago Pneumatic Tool Co.

Hydrators (Lime)
Blaw-Knox Co.
Traylor Engr. & Mfg. Co.

Jigs (Sand and Gravel)
Allis-Chalmers Mfg. Co.
Traylor Engineering & Mfg. Co.

Joist & Slab Machines (Concrete)
R & L Concrete Machy. Co.

Kerosene
Standard Oil Co. (Ind.)

Kilns Parts
Allis-Chalmers Mfg. Co.
Blaw-Knox Co.
Chicago Steel Foundry Co.
Smidth, F. L., & Co.
Traylor Engineering & Mfg. Co.

Kilns (Rotary)
Allis-Chalmers Mfg. Co.
Blaw-Knox Co.
F. L. Smidth & Co.
Traylor Engineering & Mfg. Co.

Kilns (Vertical)
Blaw-Knox Co.

Classified Directory—*Continued*

Kiln Burners
Babcock & Wilcox Co.
Smidth, F. L., & Co.

Kiln Chain Systems
Smidth, F. L., & Co.

Kiln Liners (Metal)
Traylor Engr. & Mfg. Co.

Kominuters
Smidth, F. L., & Co.

Laboratory Apparatus
Smidth, F. L., & Co.

Lift Trucks
Besser Mfg. Co.
Stearns Mfg. Co.

Lime Handling Equipment
Fuller Co.
Link-Belt Co.
Raymond Pulv. Div.
Robins Conveying Belt Co.

Lime Plants
Allis-Chalmers Mfg. Co.
American Pulverizer Co.
Blaw-Knox Co.
Gruendler Crusher & Pulv. Co.
Neff & Fry Co.
Smidth, F. L., & Co.
Traylor Engineering & Mfg. Co.

Lime Spreaders
Peoria Steel & Wire Co.

Loaders (Bin, Car, Hopper, Truck, Etc.)
Barber-Greene Co.
Besser Mfg. Co.
Bucyrus-Erie Co.
Fuller Company
Gardner-Denver Co.
Gruendler Crusher & Pulv. Co.
Geo. Haiss Mfg. Co., Inc.
Link-Belt Co.
Marion Steam Shovel Co.
New Holland Machine Co.
Northwest Engineering Co.
Robins Conveying Belt
Ross Screen & Feeder Co.
Stearns Mfg. Co.
Universal Road Machy. Co.

Loaders (Boat)
Link-Belt Co.

Loaders (Box Car)
Barber-Greene Co.
Gruendler Crusher & Pulv. Co.
Link-Belt Co.

Loaders (Underground)
Allis-Chalmers Mfg. Co.
Bay City Shovels, Inc.
Nordberg Mfg. Co.

Locomotives (Diesel and Diesel-Electric)
Davenport-Besler Corp.

Locomotives (Electric, Trolley & Storage Battery)
Davenport-Besler Corp.

Locomotives (Gasoline and Gas-Electric)
Davenport-Besler Corp.

Locomotives (Steam)
Davenport-Besler Corp.

Locomotive Stack Netting
Tyler, W. S., Co.

Lubricants
Acheson Colloids Corp.
Bacon, Earle C., Inc.
Chicago Pneumatic Tool Co.
Gulf Refining Co.
Robins Conveying Belt Co.
Standard Oil Co. (Ind.)
Texas Co.

Manganese Steel Parts
Bacon, Earle C., Inc.
Frog, Switch & Mfg. Co.

Material Handling Equipment
Allen-Sherman-Hoff Co.
Austin-Western Road Machy. Co.
Barber-Greene Co.
Fuller Company
Gruendler Crusher & Pulv. Co.
Heltzel Steel Form & Iron Co.
Link-Belt Co.
Neff & Fry Co.
Palmer-Bee Co.
Raymond Pulverizer Division
Robins Conveying Belt Co.

Measuring Devices
Blaw-Knox Co.
Heltzel Steel Form & Iron Co.
Jaeger Machine Co.

Mechanical Rubber Goods
Thermoid Rubber Co.

Mill Parts
Allis-Chalmers Mfg. Co.
Blaw-Knox Co.
Gruendler Crusher & Pulv. Co.
Smidth, F. L., & Co.
Traylor Engineering & Mfg. Co.

Mills, Grinding (Ball, Tube, Hammer, Rod, Roll, Etc.) (See also Pulverizers)
Allis-Chalmers Mfg. Co.
American Pulverizer Co.
Babcock & Wilcox Co.
Brooks Equipment & Mfg. Co.
Dixie Machinery Mfg. Co.
Gruendler Crusher & Pulv. Co.
Lewistown Foundry & Mach. Co.
Pennsylvania Crusher Co.
Raymond Pulverizer Division
F. L. Smidth & Co.
Sturtevant Mill Co.
Traylor Engineering & Mfg. Co.
Universal Crusher Co.
Williams Patent Crusher & Pulv. Co.

Mill Liners
Allis-Chalmers Mfg. Co.
Babcock & Wilcox Co.
Carnegie-Illinois Steel Corp. (U. S. Steel Corp. Subsi.)
Smidth, F. L., & Co.
Traylor Engr. & Mfg. Co.

Mortar Colors
Mepham, Geo. S., Corp.
Tamms Silica Co.

Mortar Mixers
Eagle Iron Works
Gruendler Crusher & Pulv. Co.
Jaeger Machine Co.

Nozzles (Gravel Washing)
Link-Belt Co.

Nuts
Standard Pressed Steel Co.

Oils (Lubricating)
Acheson Colloids Corp.
Bacon, Earle C., Inc.
Chicago Pneumatic Tool Co.
Gulf Refining Co.
Robins Conveying Belt Co.
Standard Oil Co. (Ind.)
The Texas Co.

Oils (Cutting)
The Texas Co.

Ornamental Forms (Concrete)
Besser Mfg. Co.

Oxygen
Weldit Acetylene Co.

Packings
Thermoid Rubber Co.

Pallets
Anchor Concrete Machinery Co.
Bacon, Earle C., Inc.
Besser Mfg. Co.
Commercial Shearing and Stamping Co.
Multiplex Concrete Machy Co.
Stearns Mfg. Co.

Pans, Grinding (Wet & Dry)
Eagle Iron Works
Traylor Engineering & Mfg. Co.

Perforated Metal
Allis-Chalmers Mfg. Co.
Bacon, Earle C., Co.
Chicago Perforating Co.
Gruendler Crusher & Pulv. Co.
Harrington & King Perf. Co.
Hendrick Mfg. Co.
Link-Belt Co.
Pioneer Engineering Wks., Inc.
Robins Conveying Belt Co.
Joseph T. Ryerson & Son, Inc.
Traylor Engr. & Mfg. Co.

Perforated Screen Plates & Cloth—See Screen Cloth & Plates

Pinions
Bacon, Earle C., Inc.
Frog, Switch & Mfg. Co.
Haiss, Geo., Mfg. Co.
Link-Belt Co.

Pipe Molds and Machines (Concrete)
Besser Mfg. Co.
Concrete Pipe Machinery Co.
R & L Concrete Machinery Co.
Stearns Mfg. Co.

Pipe
Frog, Switch & Mfg. Co.
Hetherington & Berner, Inc.
Morris Machine Works

Pipe Couplings (Flexible)
Fons Flexible Pipe Coupling Co.

Classified Directory—*Continued*

Pipe Fittings
Hetherington & Berner, Inc.

Plaster Colors
Mepham, Geo. S., Corp.

Pontoons
Eagle Iron Works
Morris Machine Works

Powder (Blasting)
Atlas Powder Co.
Hercules Powder Co.

Powder Magazines
Hercules Powder Co.

Power Transmission Machinery
Allis-Chalmers Mfg. Co.
Farrel-Birmingham Co., Inc.
Gruendler Crusher & Pulv. Co.
Link-Belt Co.
Palmer-Bee Co.
Standard Fressed Steel Co.
Timken Roller Bearing Co.

Pulleys
Allis-Chalmers Mfg. Co.
Bacon, Earle C., Co.
Gruendler Crusher & Pulv. Co.
Link-Belt Co.
Robins Conveying Belt Co.

Pulverizer Parts
Allis-Chalmers Mfg. Co.
American Pulverizer Co.
Dixie Machinery Mfg. Co.
Gruendler Crusher & Pulv. Co.
Smidth, F. L., & Co.

Pulverizers (Hammer, Ring, Rod & Roll) (See Also Mills & Crushers)
Allis-Chalmers Mfg. Co.
American Pulverizer Co.
Austin-Western Road Machy. Co.
Babcock & Wilcox Co.
Blaw-Knox Co.
Brooks Equipment & Mfg. Co.
Carnegie-Illinois Steel Corp. (U. S. Steel Corp. Subsi.)
Combustion Engr. Corp.
Dixie Machy. Mfg. Co
Gruendler Crusher & Pulv. Co.
Lewistown Foundry & Mach. Co.
New Holland Machine Co.
Pennsylvania Crusher Co.
Raymond Pulverizer Division
F. L. Smidth & Co.
Sturtevant Mill Co.
Traylor Engineering & Mfg. Co.
Universal Crusher Co.
Universal Road Machy. Co.
Williams Patent Crusher & Pulv. Co.

Pumps (Diaphragm)
Jaeger Machine Co.

Pumps (Dredge)
Allen-Sherman-Hoff Co.
Allis-Chalmers Mfg. Co.
American-Marsh Pumps, Inc.
Bucyrus-Erie Co.
Hetherington & Berner, Inc.
Jaeger Machine Co.
Morris Machine Wks.

Pumps (Dry Pulverized Material)
Babcock & Wilcox Co.
Fuller Company
Morris Machine Works
Smidth, F. L., & Co.

Pumps (Slurry)
Allen-Sherman-Hoff Co.
Allis-Chalmers Mfg. Co.
Morris Machine Wks.
Smidth, F. L., & Co.
Wilfley, A. R., & Sons, Inc.

Pumps Valves (Slurry)
Fuller Co.
Wilfley, A. R., & Son, Inc.

Pumps (Vacuum)
Allis-Chalmers Mfg. Co.
Chicago Pneumatic Tool Co.
Gardner-Denver Co.
Fuller Company
Smidth, F. L., & Co.

Pump Valves (Dry Pulverized Material)
Fuller Co.

Pumps (Water)
Allis-Chalmers Mfg. Co.
American-Marsh Pumps, Inc.
Chicago Pneumatic Tool Co.
Gardner-Denver Co.
Jaeger Machine Co.
Morris Machine Wks.

Rectifiers
Allis-Chalmers Mfg. Co.

Recuperators
Traylor Engineering & Mfg. Co.

Refractories
Smidth, F. L., & Co.

Regulators (Voltage)
Allis-Chalmers Mfg. Co.

Rewashers (Screw)
Link-Belt Co.
Smith Engineering Works

Roofing
Ryerson, Jos. T., & Son, Inc.
Texas Co.

Rope (Transmission)
Allis-Chalmers Mfg. Co.

Safety Clothing
Weldit Acetylene Co.

Sand Drags
Eagle Iron Wks.
Link-Belt Co.
Smith Engr. Wks.

Sand and Gravel Plants
Allis-Chalmers Mfg. Co.
Austin-Western Road Machy. Co.
Bacon, Earle C., Co.
Eagle Iron Works
Gruendler Crusher & Pulv. Co.
Link-Belt Co.
Neff & Fry Co.
Pioneer Engineering Wks., Inc.
Robins Conveying Belt Co.
Traylor Engineering & Mfg. Co.

Sand Separators
Link-Belt Co.
McLanahan & Stone Corp.
Pioneer Engineering Wks., Inc.
Smith Engineering Wks.

Sand Settling Tanks
Eagle Iron Wks.
Hendrick Mfg. Co.
Link-Belt Co.
Nordberg Mfg. Co.
Pioneer Engineering Wks., Inc.
Smith Engr. Wks.

Scales (Hopper)
Blaw-Knox Co.

Scrapers (Power Drag)
Austin-Western Road Machy. Co.
Blaw-Knox Co.
Bucyrus-Erie Co.
Hayward Company
Link-Belt Co.
Northwest Engineering Co.
Pioneer Engineering Wks., Inc.
Sauerman Bros., Inc.

Screen Cloth & Plates (Perforated)
Allis-Chalmers Mfg. Co.
Bacon, Earle C., Inc.
Chicago Perforating Co.
Gruendler Crusher & Pulv. Co.
Harrington & King Perf. Co.
Link-Belt Co.
Pioneer Engineering Wks., Inc.
Robins Conveying Belt Co.
Ryerson, Jos. T., & Sons, Inc.
Traylor Engineering & Mfg. Co.

Screen Parts
Allis-Chalmers Mfg. Co.
Bacon, Earle C., Co.
Gruendler Crusher & Pulv. Co.
Hendrick Mfg. Co.
Pioneer Engineering Wks., Inc.
Screen Equipment Co.
Traylor Engineering & Mfg. Co.

Screens (Grizzly)
Allis-Chalmers Mfg. Co.
Austin-Western Road Machy. Co.
Eagle Iron Works
Gruendler Crusher & Pulv. Co.
Hendrick Mfg. Co.
Lewistown Foundry & Mach. Co.
Link-Belt Co.
Pioneer Engineering Wks., Inc.
Productive Equipment Corp.
Robins Conveying Belt Co.
Ross Screen & Feeder Co.
Smith Engineering Works
Traylor Engineering & Mfg. Co.
Tyler, W. S., Co.

Classified Directory—*Continued*

Universal Road Machy. Co.
Universal Vibrating Screen Co.

Screens (Laboratory)
Allis-Chalmers Mfg. Co.
Gruendler Crusher & Pulv. Co.
Hendrick Mfg. Co.
Link-Belt Co.
Smidth, F. L., & Co.
Tyler, W. S., Co.
Williams Patent Crusher & Pulv. Co.

Screens (Revolving)
Allis-Chalmers Mfg. Co.
Austin-Western Road Machy. Co.
Bacon, Earle C., Inc.
Eagle Iron Wks.
Gruendler Crusher & Pulv. Co.
Haiss, Geo., Mfg. Co., Inc.
Link-Belt Co.
Pioneer Engineering Wks., Inc.
Robins Conveying Belt Co.
Smith Engr. Wks.
Traylor Engr. & Mfg| Co.
Tyler, W. S., Co.
Universal Road Machy. Co.

Screens, Scalping
Allis-Chalmers Mfg. Co.
Link-Belt Co.
McLanahan & Stone Corp.
Smith Engineering Works
Williams Patent Crusher & Pulv. Co.

Screens (Trommel)
Traylor Engr. & Mfg. Co.

Screens (Vibrating)
Allis-Chalmers Mfg. Co
Austin-Western Road Machy. Co.
Bacon, Earle C., Co.
Eagle Iron Works
Gruendler Crusher & Pulv. Co.
Hendrick Mfg. Co.
Lewistown Fdry. & Mach. Co.
Link-Belt Co.
McLanahan & Stone Corp.
New Holland Machine Co.
Nordberg Mfg. Co
Pioneer Engineering Wks., Inc.
Robins Conveying Belt Co.
Screen Equipment Co.
Smith Engineering Works
Sturtevant Mill Co.
W. S. Tyler Co.
Universal Crusher Co.
Universal Vib. Screen Co.
Williams Patent Crusher & Pulv. Co.

Screws (Cap, Self Locking, Set, Hollow Set)
Standard Pressed Steel Co.

Seal Rings
Traylor Engineering & Mfg. Co.

Semi-Trailers, Quarry (Side & End Dumping)
Easton Car & Const. Co.

Shafting
Allis-Chalmers Mfg. Co.
Bacon, Earle C., Inc.
Link-Belt Co.

Shale Planers
Eagle Iron Wks.

Sheaves
Allis-Chalmers Mfg. Co.
Eagle Iron Works
Gruendler Crusher & Pulv. Co.
Haiss, Geo., Mfg. Co.
Hetherington & Berner, Inc.
Link-Belt Co.
McLanahan & Stone Corp.
Pioneer Engineering Wks., Inc.
Sauerman Bros.

Shovels (Compressed Air)
Nordberg Mfg. Co.

Shovels, Power (Diesel, Diesel-Air, Electric, Gasoline, Gas-Electric, Oil & Steam)
Austin-Western Road Machy. Co.
Bay City Shovels, Inc.
Bucyrus-Erie Co.
Industrial Brownhoist Corp.
Lima Locomotive Wks., Inc. (Shovel & Crane Div.)
Link-Belt Co.
Marion Steam Shovel Co.
Northwest Engineering Co.

Shovels (Tractor)
Austin-Western Road Machy. Co.
Bay City Shovels, Inc.
Lima Locomotive Wks., Inc. (Shovel & Crane Div.)
Link-Belt Co.

Shovels (Truck)
Bay City Shovels, Inc.

Shovels (Underground)
Allis-Chalmers Mfg. Co.
Bay City Shovels, Inc.
Lima Locomotive Wks., Inc. (Shovel & Crane Div.)
Nordberg Mfg. Co.

Shredders
Williams Patent Crusher & Pulv. Co.

Sieves (Testing)
Hendrick Mfg. Co.
Smidth, F. L., & Co.
Tyler, W. S., Co.

Silos
Blaw-Knox Co.
Neff & Fry Co.
F. L. Smidth & Co.

Silo Stave Machines (Concrete)
Besser Mfg. Co.

Skids
Besser Mfg. Co.
Easton Car & Const. Co.

Slakers (Rotary)
Traylor Engineering & Mfg. Co.

Slugs (Grinding)
Smidth, F. L., & Co.

Slurry Mixers
Smidth, F. L., & Co.
Traylor Engr. & Mfg. Co.

Slurry Separators
Smidth, F. L., & Co.

Slurry Thickeners
Smidth, F. L., & Co.
Traylor Engr. & Mfg. Co.

Smokestacks
Hendrick Mfg. Co.
Traylor Engineering & Mfg. Co.

Speed Reducers
Allis-Chalmers Mfg. Co.
Bacon, Earle C., Co.
Farrel-Birmingham Co., Inc.
Link-Belt Co
Palmer-Bee Co.
Smidth, F. L., & Co.
Traylor Engineering & Mfg. Co.

Spouts
Gruendler Crusher & Pulv. Co.
Link-Belt Co.
Traylor Engineering & Mfg. Co.

Sprockets
Allis-Chalmers Mfg. Co.
Bacon, Earle C., Co.
Link-Belt Co.
Palmer-Bee Co.

Standpipes
Ross Screen & Feeder Co.

Steel, Abrasion Resisting
Joseph T. Ryerson & Son, Inc.

Steel (Electric Furnace)
Chicago Steel Foundry Co.
Timken Roller Bearing Co.

Steel (Open Hearth)
Timken Roller Bearing Co.

Steel (Special Alloy)
Chicago Steel Foundry Co.
Timken Roller Bearing Co.

Stokers
Babcock & Wilcox Co.
Combustion Engineering Corp.
Link-Belt Co.

Storage Equipment
Barber-Greene Co.
Blaw-Knox Co.
Haiss, Geo., Mfg. Co.
Link-Belt Co.
Neff & Fry Co.
Robins Conveying Belt Co.
Sauerman Bros., Inc.

Stucco Colors
Mepham, Geo. S., Corp.

Switchboards
Allis-Chalmers Mfg. Co.

Tampers (Power & Hand)
Besser Mfg. Co.
Multiplex Concrete Machy Co.
Stearns Mfg. Co.

Tanks
Allis-Chalmers Mfg. Co.
Blaw-Knox Co.
Chicago Pneumatic Tool Co.
Combustion Engineering Corp.
Eagle Iron Works
Heltzel Steel Form & Iron Co.

Classified Directory—*Continued*

Hendrick Mfg. Co.
Link-Belt Co.
Neff & Fry Co.
Pioneer Engineering Wks., Inc.
Raymond Pulverizer Division
Traylor Engineering & Mfg. Co.

Towers
Blaw-Knox Co.
Eagle Iron Works
Hendrick Mfg. Co.
Jaeger Machine Co.
Neff & Fry Co.
Robins Conveying Belt Co.
Sauerman Bros., Inc.

Track & Track Equipment
Besser Mfg. Co.
Carnegie-Illinois Steel Corp. (U. S. Steel Corp. Subsl.)
Easton Car & Const. Co.
Nordberg Mfg. Co.

Track Shifters
Nordberg Mfg. Co.

Track Systems (Overhead)
Link-Belt Co.

Tractors
Allis-Chalmers Mfg. Co.

Tractors (Electric)
Link-Belt Co.

Trailers (Industrial & Quarry)
Allis-Chalmers Mfg. Co.
Athey Truss Wheel Co.
Austin-Western Road Machy. Co.
Easton Car & Const. Co.

Transformers
Allis-Chalmers Mfg. Co.

Trucks (Agitator)
Blaw-Knox Co.

Trucks (Dump)
Ford Motor Co.

Truck Bodies (Dump)
Athey Truss Wheel Co.
Commercial Shearing & Stamping Co.
Dempster Bros.
Easton Car & Const. Co.
Ford Motor Co.

Trucks (Electric)
Easton Car & Const. Co.

Trucks (Gas-Electric)
Easton Car & Const. Co.

Trucks (Hand)
Standard Pressed Steel Co.

Trucks (Industrial)
Easton Car & Const. Co.
Standard Pressed Steel Co.

Trucks (Mixers)
Blaw-Knox Co.
Jaeger Machine Co
Smidth, F. L., & Co.
Smith, T. L., Co.

Tubing (Seamless Steel)
Timken Roller Bearing Co.

Turbines
Allis-Chalmers Mfg. Co.

Turntables (Industrial)
Easton Car & Const. Co.

Unloaders
Barber-Greene Co.
Bucyrus-Erie Co.
Fuller Company
Gruendler Crusher & Pulv. Co.
Haiss, Geo., Mfg. Co.
Link-Belt Co.
Marion Steam Shovel Co.
New Holland Machine Co.
Northwest Engineering Co.
Robins Conveying Belt Co.
Universal Road Machy. Co.

Unloaders (Boat)
Link-Belt Co.

Unloaders (Box Car)
Barber-Greene Co.
Besser Mfg. Co.
Fuller Co.
Gruendler Crusher & Pulv. Co.
Link-Belt Co.
Stearns Mfg. Co.
Universal Road Machy. Co.

Unloaders (Pneumatic)
Fuller Company

Unloaders (Underground)
Bay City Shovels, Inc.
Nordberg Mfg. Co.

Ventilating Apparatus
Blaw-Knox Co.
Connecticut Blower Co.

Vibrators
Link-Belt Co.
W. S. Tyler Co.
Stearns Mfg. Co.

Wagons (Dump)
Allis-Chalmers Mfg. Co.
Athey Truss Wheel Co.
Austin-Western Road Machy. Co.
Blaw-Knox Co.
Easton Car & Const. Co.

Washers (Log)
Allis-Chalmers Mfg. Co.
Eagle Iron Works
Link-Belt Co.
McLanahan & Stone Corp.
Pioneer Engineering Wks., Inc.
Smith Engineering Works
Traylor Engr. & Mfg. Co.

Washers (Sand, Gravel and Stone)
Allis-Chalmers Mfg. Co.
Austin-Western Road Machy. Co.
Bacon, Earle C., Co.
Eagle Iron Works
Gruendler Crusher & Pulv. Co.
Haiss, Geo., Mfg. Co.
Hendrick Mfg. Co.
Lewistown Foundry & Mach. Co.
Link-Belt Co.
McLanahan & Stone Corp.
Pioneer Engineering Wks., Inc.
Robins Conveying Belt Co.
Smidth, F. L., & Co.
Smith Engineering Wks.
Traylor Engr. & Mfg. Co.
Tyler, W. S., Co.
Universal Crusher Co.
Universal Road Machy. Co.
Universal Vibrating Screen Co.

Weighing Equipment
Blaw-Knox Co.
Fuller Company
Heltzel Steel Form & Iron Co.
Jaeger Machine Co.

Welding & Cutting Equipment
Weldit Acetylene Co.

Welding Rods
Ryerson, Jos. T., & Son, Inc.
Weldit Acetylene Co.

Welding Wire
Weldit Acetylene Co.

Wheels (Track Laying Type)
Athey Truss Wheel Co.

Winches
Dake Engine Co.
Link-Belt Co.
Robins Conveying Belt Co.

Wire Cloth
Bacon, Earle C., Co.
Cleveland Wire Cloth & Mfg. Co.
Eagle Iron Works
Leschen, A., & Sons Rope Co.
Link-Belt Co.
Ludlow-Saylor Wire Co.
Pioneer Engineering Wks., Inc.
Robins Conveying Belt Co.
Screen Equipment Co.
Tyler, W. S., Co.
Universal Vibrating Screen Co.

Wire Rope
American Cable Co., Inc.
Broderick & Bascom Rope Co. (Yellow Strand)
A. Leschen & Sons Rope Co.

Wire Rope Clips
American Cable Co.
Broderick & Bascom Rope Co.
Leschen, A., & Sons Rope Co.

Wire Rope Fittings
American Cable Co.
Broderick & Bascom Rope Co.
Leschen, A., & Sons Rope Co.

Wire Rope Hooks
American Cable Co.
Leschen, A., & Sons Rope Co.

Wire Rope Lubricants
Broderick & Bascom Rope Co.
Texas Co.

Wire Rope Slings
American Cable Co.
Broderick & Bascom Rope Co.
Leschen, A., & Sons Rope Co.

Wire Rope Sockets
American Cable Co.
Leschen, A., & Sons Rope Co.

CLASSIFIED ADVERTISEMENTS—*Used Equipment for Sale*

CONSOLIDATED
GOOD USED EQUIPMENT

Selected Specials

10—Jaw Crushers: 15x24", 15x36" Farrel; 18x30" Allis-Chalmers; 18x36", 24x36" Farrel; 24x36" Allis-Chalmers; 30x60" Traylor; 30x42" Buchanan; 36x42" Traylor; 42x60" Farrel. Also all smaller sizes.

8—Vibrating Screens: 3x6' Huron; 3x6', 4x6' Niagara; 4x8' Allis-Chalmers. All double deck.

9—Tyler Hummer Screens: Types 31, 33, 37, 39, 60.

13—Rotary Dryers, Direct Heat: 4x30', 5x26', 5x30', 5'6"x40', 6x40', 6'8"x40', 8x60', 9x86'. Also Rotary Kilns up to 9'6"x150'.

5—Raymond Roller Mills, 4-roll and 5-roll, low and high side. Also all sizes Raymond beater type and Imp pulverizers.

7—Centrifugal Air Separators: 30", 5', 8', 12', 14' Gayco; 10' Sturtevant.

These items in one plant—Used one week—Condition 99% of new:

1—5'x35' 3-compartment Tube Mill, iron lined with direct connected 300 H. P. motor. Complete.
1—4x40' Rotary Dryer.
1—Schaeffer Foidometer, size 20 x4'6". Complete.
1—13x8x8 Penna. D-2 Air Compressor.
1—4" Fuller-Kenyon Type B Dust Pump.
1—12"x15' Jeffrey Apron Conveyor.

Above with 25 cycle Motors, sold with or without motors.

9—Single Roll Crushers: 24x24" Link-Belt; 18", 24", 36x36" Jeffrey; 18x16", 21x40", 21x50" Penna.
1—4'x22" Hardinge Ball Mill.
1—36x36" 4XC Gruendler Hammer Mill, roller bearings. Also other types and sizes.

Send for latest copy Consolidated News listing hundreds of machines for sale

Consolidated Products Co., Inc.
15-16-17 Park Row, New York City
8 Acre Plant & Shops at Newark, N. J.

GREGORY "HI-GRADE-REBUILT" Electric Motor and Machy. Bargains

● MONEY BACK GUARANTEE ●

A C MOTORS
D C MOTORS
MOTOR-GENERATOR SETS
ARC WELDERS

METERS
TRANSFORMERS
AIR COMPRESSORS
CENTRIFUGAL PUMPS

SAVE MONEY **Send Us Your Inquiries** **Write—Phone—Wire**

GREGORY ELECTRIC CO. (Est. 1893)
1601-A SO. WOLCOTT AVE. (formerly Lincoln St.)
CHICAGO
Phone—Canal 1690

FOR SALE

One WJ3 Sullivan stationary air compressor, 8¼ x 10 x 14, delivery 531 cubic feet, complete with 100 horse power Western Electric motor attached—half price. Also three Allis Chalmers Gates crushers, Nos. 6, 4 and 2; pumps, hoists, motors, shovels and other quarry equipment.

KAUKAUNA QUARRY COMPANY
Kaukauna, Wisconsin

3—50 HP electric shaft hoists.
2—60 HP electric DD hoists.
1—100 HP electric DD hoist.
1—150 HP dragline DD hoist, 3 yd.
⅝ yd. Byers shovel.
½ yd. Buyers comb. shovel crane.
¾ yd. Osgood comb. shovel crane.
¾ yd. Northwest shovel.
1 yd. Northwest shovel.
Asphalt plants 1250 yd., 1800 yd.
Owen & Hayward ⅝ and 1 yd. buckets.
Compressors 446, 310, 136, 110 ft.
Sullivan and I-Rand jackhammers.
Barnes pumps S.P. 3, 4, 6 gas & elec.
Worthington 3" pump elec. 75 ft. head.

J. T. WALSH
BRISBANE BLDG. BUFFALO, N. Y.

2, 4 & 5½' Symons Cone Crusher.
No. 6, 10 & 18 Superior McCully Gyr. Crushers.
8x12" to 66x84" Jaw Crushers.
Steam, Gasoline and Electric Shovels ⅝ to 8 yd.
33, 40 and 50 ton Saddle Tank Std. ga. Locomotives.
Std. ga. Locomotive Cranes, also Gas. Caterpillar.
40-Koppel 6 yd. std. ga. Two-Way Dump Cars.
Diesel Engines, 50-750 HP.
Derricks, Compressors, Conveyors, Rotary Dryers.
Screens, Bins, Motors, Generators, Gravel Plants.
Let us have your inquiries. Ask for Bulletin No. 38.

MID-CONTINENT EQUIPMENT CO.
710 EASTGATE PAL. 2290 ST. LOUIS, MO.

SAVE

Bolted type steel bins will cost you less erected than ordinary wood bins.

New and Used Pipe and Tubing

Jos. Greenspon's Son Pipe Corp.
Natl. Stock Yds (St. Clair Co.) Ill.

OFFERING OF USED EQUIPMENT

Standard Track Gauge 4'8½"

CARS

18—K&J 16-yd. Dump Cars.
200—50-ton All Steel Hopper Cars.
50—30-ton Steel u/f Flat Cars.
20—40-ton Steel u/f Flat Cars.
100—30-ton Steel u/f Box Cars

LOCOMOTIVE CRANES

1—22½-Ton Ohio.
2—25-Ton Ohio.
1—30-Ton Ohio.

LOCOMOTIVES

3—75-Ton, 6-Wheel Switchers.

MISCELLANEOUS EQUIPMENT

3—400-Ton Wheel Presses.

A.A.R. Standard Car Parts
Cast Steel Car Truck Side Frames

RAILWAY ACCESSORIES COMPANY
3401-9 CAREW TOWER CINCINNATI, OHIO

For Sale — A Good Time to Buy

Scows (steel) (2) 100'x32'x10'.
Hoist Nordberg mine D/D-8 ton electric.
Jaw Crusher P&M 24x36 Mang.
Pebble Mill Hardinge type A 8'x22".
R R Track Scale 125 ton Fairbanks.
Tanks steel horiz.—12,000 gals. 10'x18'.
Dragline Bucket 2½ yd. Mang.
Hydrator (Clyde) 10'4" dia. gear drive.
Crushers 5K-6K motor drive.
Derricks steel stiff leg 75 ton 140' B.

A. V. KONSBERG
111 W. JACKSON BLVD., CHICAGO

3-hp. FBM. Gasoline	$ 35.00
10-hp. Full Diesel Oil Engine	100.00
15-hp. FBM. Oil Engine	200.00
20-hp. Full Diesel Oil Engine	275.00
40-hp. Full Diesel Oil Engine	450.00
90-hp. 3-Cyld. Anderson Oil Engine	900.00
120-hp. Full Diesel Oil Engine	1200.00
2-Cyld. 6x6" Curtis Air Compressor	175.00
65 Kva 3/60/2300 V257 rpm. Generator	425.00

All sizes and makes Diesel Oil Engines from 20 to 1000-hp. Also Motors, Generators, Compressors, Quarry equipment.

J. D. ANDERSON MACHINERY COMPANY
5516 MAPLE AVE., ST. LOUIS, MO.

"E. C. A. Rebuilt" Quarry and Gravel Plant Equipment

AIR COMPRESSORS

Portable and stationary, belt with elec. or gas power, sizes from 21 cu. ft. to 1,000 cu. ft.

BINS

2—2 compartment with scales, 10,000 lbs. cap.; 1—150 ton Blaw Knox; 1—112 ton Butler.
10—2 compartment: 4—118 ton Blaw Knox; 1—87 ton Blaw Knox; 1—64 yd. Johnston; 1—60 ton Butler; 2—35 ton Blaw Knox; 1—20 ton Heltzel. With or without weigh batchers.
1—1,200 bbl. Blaw Knox round bulk cement bin with 2,000 lbs. weigh batcher.

BUCKETS

1—4 yd. Hayward class G clamshell.
35—Williams, Blaw Knox & Owen clamshell—all sizes & types.
5—Page dragline: 2—1½ yd.; 2—1¼ yd.; 1—1 yd.
6—Dragscraper: 3—1 yd. Green & Cedar Rapids; 1—¾ yd. Sauerman; 2—½ yd. Green.

CRANES (Locomotive)

1—25-Ton Browning locomotive crane No. 1854, 8-wheel, std. ga., 50' boom.

CRANES & DRAGLINES

1—Link-Belt K-55, ser. No. 1098, 70' boom, 2 yd. bucket, also have 2 yd. shovel attachment.
2—Northwest, model 104, ser. nos. 2079 & 1597, 45' boom, 1¼ yd. bucket; one with 1 yd. shovel attachment.
1—Link-Belt mod. K-42, ser. No. 1265, 45' boom, 1¼ yd. bucket; also have 1 yd. trench hoe attachment or 1¼ yd. shovel front.
1—Northwest mod. 105, ser. No. 2053, 40' boom, 1 yd. bucket.
1—Link-Belt mod. K-1, ser No. 1024, 50' boom, 1 yd. bucket.
1—Osgood Heavy Duty, ser. No. 2089, 40' boom, 1 yd. bucket & with 1 yd. shovel attachment.
1—Bucyrus-Erie mod. 1030, ser. No. 10512, 45' boom & ¾ yd. shovel front.
1—Brownhoist No. 1, ser. No. 10057, 30' boom, ½ yd. shovel front.
1—Byers Bearcat mod. 27, ser. No. 5289, 30' boom, ½ circle swing, ½ yd. bucket.
1—Erie type B-2, ser. No. 4122, steam crane, 40' boom, 1 yd. bucket.

CRUSHERS

3—Gyratory: 1—Allis Chalmers Gates No. 5; 1—McCully No. 3; 1—McCully No. 6.
3—Jaw Crushers; 1—12x26" Champion No. 6; 1—10x20" Climax No. 2½; 1—9x16" Telsmith No. 9-A.
1—Set of Allis Chalmers smooth type crushing rolls, size 42x16".

DERRICKS

4—Steel stiff leg: 1—15 ton Dobbie, 100' boom; 1—15 ton Clyde, 50' boom; 1—15 ton Clyde "A" frame barge derrick, 50' boom; 1—10 ton Insley, 80' boom.

ROCK DRILLS

6—Wagon drills: Ing. Rand & Gard. Denver with I. R. X-71 & G. D. 17 & 21 drills.
67—Jackhammer drills: Ing. Rand. DCR 23 & S-49 and Gard. Denver mod. 87 & 11-D.
21—Column & tripod drills: Ing. Rand Mods. X-71 & JC-11 and Gard. Denver mod. 17.

LOADERS

3—Bucket loaders: 2—Barber Greene (1—mod. 42-B, No. 42-12-59; 1—mod. 42-A, No. 23431); 1—Haiss No. C-7042.

PUMPS

5—Dredge pumps: 1—10" Morris manganese; 1—8" Cataract No. 175895; 1—8" Morris; 1—6" Erie; 1—6" Fairbanks Morse Woods trash pump.

TRACTORS

3—Allis Chalmers mod. "L" tractors, Nos. 682, 1670 & 1691, with Baker hydraulic bulldozers.
4—Caterpillar: 1—mod. 65, ser. No. 2-D-201; 2—mod. 60, ser. Nos. 5842 & 5876; 1—mod. 30, ser. No. 7969.

WHIRLEY

1—Mod. 75 Wiley Whirley No. 2978, 20 tons cap., 75' boom, SD Clyde, 80 HP, elec. hoist & 30 HP elec. swinger, all complete. Perfect condition.

SEND FOR COMPLETE NEW STOCK LIST.

EQUIPMENT CORPORATION OF AMERICA

PHILADELPHIA — P. O. Box 5471, Kingsessing Sta. — Phone Granite 7600
CHICAGO — 1119 S. Washtenaw Ave. — Phone Nevada 2400
PITTSBURGH — P. O. Box 955 — Phone Federal 2060

1—120 HP Fairbanks Morse full diesel AC oil engine generator set.
2—240 HP Fairbanks Morse full diesel oil engine generator sets, 170 KVA generators.
300 HP Fairbanks Morse Type Y Style V oil engine, clutch pulley.
300, 400, 500 HP water tube boilers.
100, 150 and 200 HP HRT boilers.
500, 750, 1000, 2000 KW turbo-generator sets.
2—500 HP, 435 RPM, slip ring motors, 3-60-2300 volts. AC control.
1—14x14x10 Sullivan angle compound air compressor complete with air receiver, only used six months.
This is only a partial list. We have oil engines in all sizes, motors, boilers, air compressors, pumps.

FLETCHER SALES COMPANY
835 Security Trust Bldg.
INDIANAPOLIS INDIANA

BARGAINS

Blaw-Knox 6 yd. Agitator Body—Rebuilt	$1750.00
Blaw-Knox 4 yd. Truck Mixer Body—Rebuilt	2000.00
P&H ⅝ yd. Gas Shovel	2250.00
Schramm 260' Compressor and Cleveland Wagon Drill (used two months)	3200.00
Jaeger 1½ yd. Truck Mixer mounted on Stewart Truck —New 1937	2200.00

SERVICE SUPPLY CORP.
20th & Venango Sts. Phila., Pa.

RAILS—1 Ton or 1000

NEW RAILS—5000 tons—All Sections—All Sizes.
RELAYING RAILS—25,000 tons—All Sections—All Sizes, practically as good as New.
ACCESSORIES—New—Every Track Accessory carried in stock—Angle and Splice Bars, Bolts, Nuts, Frogs, Switches, Tie Plates.
Buy from One Source—Save Time and Money.
'Phone, Write or Wire.

L. B. FOSTER COMPANY, Inc.
PITTSBURGH NEW YORK CHICAGO

No. 7 Newhouse Fine Reduction Gyr. Crusher.
36" Superior McCully Gyratory. Like new.
12-N Allis Chalmers Gyratory. Never used.
16" Superior McCully, manganese fitted.
No. 9 Telsmith Primary, new 1928. Used 1 yr.
20 & 33 ton Whitcomb gasoline locomotives.
¾ yd. Northwest No. 3 Shovel-Crane. Rebuilt.

MISSISSIPPI VALLEY EQUIPMENT CO.
515 LOCUST ST. ST. LOUIS, MO.
Send for Bulletin No. 116

FOR SALE

1—10 Ft. Wood Automatic Gas Producer.
1—10 Ft. 6 In. Wellman Type L Gas Producer.
2—36x16 In. Allis-Chalmers Type B Roll Crushers.
2—Gates 6-K Gyratory Crushers.
1—36 In. Symons Horizontal Disc Crusher.
New 60" O. D. Revolving Screen Sections.
New Repair Parts for Marion Model 36 Steam Shovels.

K. E. Yount
2000 First National Bank Bldg.
Baltimore, Maryland

---

120 Robins 24" wide Trough Idlers.
800 Ft. Conveyor Belt 30" wide, 7 ply.
Belt Conveyors—36"x150' & 30"x275'.
Conveyors—14", 16", 24", 30" & 36" wide.
18" & 30" wide Robins Belt Trippers.
Portable Belt Conveyor 16"x25'.
Link-Belt Bag Conveyor 30"x32'.
L-B Encased Bucket Elevator 10"x35'.
Allen 6' & 8' Sand Tanks, type 100.
Jeffrey Vertical Bucket Elevator 14"x30'.
Continuous Inclined Elevator 14"x47'.
10 Elect. Centrif. Pumps—105 to 1000-g.
N.E. Revolving Stone Screen 5'x24'.
Hummer 3x5 & 4x5 Vibr. 2-deck Screens.
L-B 3x8' Vibrating 1-deck Screen.
Leahy 3x8' Vibrating 2-deck Screen.
Kennedy 37-S Gearless Crusher, 50-hp.
Penna. Coal Crusher, 1-roll, 18"x24".
B-K Dreadnaught ¾-yd. Digging Bucket.
Hayward E Clamshell ½ & 2 yd. Buckets.
45 Ft. Crane Boom for Koehring No. 301.

G. A. UNVERZAGT
15 Park Row—New York City

FOR SALE OR FOR RENT

3—5-ton Pierce-Arrow Dump Body Trucks.
2—9B3 and 1 No. 7 McKiernan-Terry Steam Hammers.
1—3-Drum Thomas Elec. Hoist with boom swinger.
1—75-B Lorain, 1¼-yd. Gas Shovel with dragline attachment, 55' boom, 1-yd. bucket.
1—Model 78 Northwest 2-yd. Shovel, 2 yrs. old with oil engine.
1—50-B Bucyrus-Erie Diesel Dragline or Crane.
1—50-B Bucyrus-Erie Steam Shovel, or Dragline.
2—Vulcan, 18-ton gasoline locomotives.
1—12-ton Std. Ga. Plymouth Gasoline Locomotive.
10—21-ton, 25-ton, 28-ton and 35-ton Std. Ga. Steam Saddle Tank Locomotives.
4—50-ton, 17x24, Davenport, 6-wheel Switchers.
1—22½-ton Industrial Steam Locomotive Crane. 12-yd., 16-yd., 20 yd., 30-yd. standard gauge Dump Cars
General Construction Equipment

CLAPP, RILEY & HALL EQUIPMENT CO.
14 North Clinton St., Chicago, Illinois

RELIABLE USED EQUIPMENT

Lorain 75A 1¼ yard Gasoline Shovel.
Lima 602 Diesel Dragline, 60' Boom, 1⅛ yard bucket.
Lima 602 Gasoline Dragline, 60' Boom, 1⅛ yard Page Bucket.
Lima 601 Gas Combination Dragline & Shovel. On Dragline 60' Boom, 1⅛ yard Page Bucket. Two 1⅛ yard manganese dippers included with shovel front.
Lima 701 Gasoline Dragline, 70' Boom, 2 yard Page Bucket.
43-B Bucyrus-Erie Diesel Dragline, 75' Boom, 2¼ yard Page Bucket.
46-B Bucyrus-Erie Dragline, 75' Boom, 2⅛ yard Page Bucket.
P&H 900 Diesel Dragline, 100' Boom, 2⅛ yard bucket. Excellent condition.
Marion No. 5120 Electric Dragline, 100' Boom, 3 yard Bucket.
75-B Bucyrus-Erie Electric Combination Dragline & Shovel. As dragline, 85' boom, 2⅛ yard bucket. As shovel, 29' boom, 20' dipper sticks, 2⅛ yard bucket.
120-B Bucyrus-Erie Electric Shovel.
Brownhoist 20-ton DC **Gasoline Crane** 30' Boom.
1—1½ yard **Page Dragline Bucket.**
1—2¼ yard **Page Dragline Bucket.**
2—**Caterpillar 75 Diesel Tractors.**
2—**LaPlante Choate Crawler Wagons.**
1—**LaPlante Choate Bulldozer** for 75 Tractor.
3—11x16 42" gauge **Saddle Tank Locomotives.**
1—Std. gauge 42-ton **Heisler Geared Locomotive.**
1—**Sanderson Cyclone Full Crawler Gas Well Drill.**
1—**Loomis 44 Full Crawler Electric Well Drill.**

FRANK SWABB EQUIPMENT CO.
Hazleton, Pa.
Telephone 3906

PIPE * PLATES * TIMBERS

All Sizes	3/16", ¼",	5" x 12" x 14'
New—Used	5/16" & ⅜"	5" x 12" x 15'
Air—Steam	All 5' wide	6" x 6" x 18'
Casing	& 10' long	6" x 6" x 24'

BRADFORD SUPPLY CO., INC.
WAYNE, WOOD CO., OHIO

CONCRETE BLOCK MACHINERY

Increase your income — our Catch Basin Molds and Manhole Block Machines will add profitable products to your business.
Complete Block plant near Chicago For Sale.

H. W. LACKEY
858 East 39th Street Chicago, Ill.
Send us a list of the equipment you want to sell.

CLASSIFIED ADVERTISEMENTS—*Used Equipment For Sale*

FOR SALE

Assets of the bankrupt Marianna Lime Products Company plant installed 1928 to 1932 but little used and equipment is now in virtually new condition. Everything will positively be sacrificed for **quick sale.**

No. 8 Williams Jumbo Hammer Mill 56x60" with extra set new hammers.
5—Ocala Knob Roll Crushers 24'x36 to 30x54' (three of them never used).
3 ft. x 16 ft. Allis-Chalmers Revolving Screen (new).
1½ yard Lorain (Thew) combination Dragline and Shovel with Atlas Imperial full Diesel equipped with 1¼ yard dipper and drag line bucket.
This machine has seen only a few months of actual service and could be described as a new or demonstrator's rig.

⅞ Yard Bucyrus Erie Steam Shovel, good operating condition.
120 H.P. Fairbanks-Morse full Diesel Engine 2-cylinder.
240 H.P. Fairbanks-Morse full Diesel Engine 4-cylinder. (Both in excellent condition.)
Several Hoisting Engines.
3—Fairbanks Morse 125 H.P. slip ring Motors, 2200 volt, 3 phase, 60 cycle, 700 R.P.M. with drum controls, etc.
1 to 12 Yard 2-way Dump Cars.

ALSO:

3—Raymond Mills.
No. 4 and No. 6 Williams Hammer Mills.
1—Christie Dryer, 90" diameter, 54' long.
1—Bucyrus Erie 1 yd. combination drag line and shovel, powered by Atlas Diesel.
Sullivan Drill Sharpener.
Ten Tons new ⅞" hollow hex drill steel.
Jackhammers, Drifters, etc.
Three miles 65 lb. rails.
Five miles 80 lb. rails.
Large lot troughing idlers and belt conveyors.

Three Sullivan gas-portable 140 ft. Air Compressors (actual delivery).
Two Sullivan gas-portable 210 ft. Air Compressor (actual delivery).
1000 ft. 36" 6 ply 32 oz. rubber conveyor belt, bought new 1937 and never taken from spools.
370 ft. 30" conveyor belt.
270 ft. 24" conveyor belt.
160 ft. 18" conveyor belt.
Car load cable ⅝ to 1½" new and used.

W. M. SMITH & COMPANY

45th to 48th Sts. First Ave., No. BIRMINGHAM, ALA.

FOR SALE

50 Ton American 4-wheel saddle tank locomotive, 16x24" cylinders.
40 Ton American 4-wheel saddle tank locomotive, 14x22" cylinders. Three duplicates.
38 Ton Vulcan 4-wheel saddle tank locomotive, 14x20" cylinders.
38 Ton Davenport 4-wheel saddle tank locomotive, 14x20" cylinders.
36 Ton Porter 4-wheel saddle tank locomotive, 14x20" cylinders.
30 Ton Vulcan 4-wheel saddle tank locomotive, 13x18" cylinders, 36" gauge.
21 Ton Vulcan 4-wheel saddle tank locomotive, 11x16" cylinders, 36" gauge. Three duplicates.

All equipped with A.S.M.E. boilers.

Complete stock list on request.

BIRMINGHAM RAIL & LOCOMOTIVE COMPANY
BIRMINGHAM, ALABAMA

JAW CRUSHERS

16x8, 13x7½, 14x7, 15x9, 15x10, 16x9, 16x12, 16x10, 18x11, 20x8, 20x6, 20x10, 20x12, 20x11, 26x12, 30x15, 30x13, 36x30, 36x18, 36x14, 36x9, 36x6, 38x18, 36x10, 36x24, 42x9, 48x36, 60x42, 84x66, 36x16, 9x36, 12x26 Champion, Screen & Elevator.

CONE & GYRATORY CRUSHERS

18 in., 24 in., 30 in., and 36 in. Symons Disc.
4-10 TZ Traylor 4 ft. Gyratory.
4—Nos. 5, 3 & 6 Austin Gyratory.
2—Traylor T-12 Bulldog Gyratory.
No. 6 BH Traylor Fine Reduction.
17 Gates K—Nos. 3, 4, 5, 6, 7½, 8 & 9½.
2 Ft. Symons Cone Crusher.
10 Inch Austin Model 105.
10 & 13 Inch Superior McCullys.

CLAM SHELL BUCKETS

¾ yd. cap. Williams Hercules Digger.
¾ yd. cap. Hayward Material Handling.
6 Blaw-Knox & Owen 1 to 2 yd. cap.

CONVEYOR & ELEVATOR PARTS

Elevator Belt 300 Ft. 20 In., 400 Ft. 18 In.
Conveyor Belt 1750 Ft. 60 In., 1200 Ft. 30 In. 723 Ft. 24 In., 320 Ft. 20 In., 718 Ft. 16 In.
Idlers & Head & Tails—18—20—24—30 & 36".

MISCELLANEOUS

Air Compressors: 310, 528, 676 & 1300 ft. & 2600 ft.
Gas Locomotives: (12) from 3 to 16 tons.
Derricks: (8) Stiff Leg & Guy Type.
Sauerman Outfits: ½ yd., 1 yd., & 1½ yd.
Rotary Dryers: 8'0"x84 ft., 6'0"x50 ft., 5'8"x60 ft., 4'0"x30 ft., 3'6"x24 ft., 3'0"x20 ft.
125 ton Fairbanks R.R. Scale—50 ft.
8'x12' Rod Mill & 30" Griffin Mill.
8'x6' KVS & 5'x22" Hardinge Ball Mill.
No. 0000 Raymond Mill & Separator.
125 HP Erie Economic Boiler.
2 Type B Fuller Kinyon Cement Pumps.
30—1½ & 2 Yd. Steel Skip Boxes.

R. C. STANHOPE, INC.
875 Sixth Ave. New York, N. Y.

STORAGE BINS

231 cu. yds. circular bin, steel bolted.
Blaw-Knox 51 tons, two compts., weigh batchers.
Blaw-Knox 72 tons, two compts., volume batchers.
Fuller 155 bbls. cement, electric weigh batchers.

CRUSHERS

Jaw—6x12, 9x16, 10x16, 10x20, 13x30, 24x36, 48x36.
Gyratory—No. 5 McCulley, No. 37 Kennedy Van Saun.

CONVEYOR EQUIPMENT

Troughing rollers and return idlers, 16", 18", 20", 24", 30", 36".
Conveyor belt, 18", 20", 24", 30", 36".
Head and tail pulleys with take ups in any size.
Brand new 24" belt conveyor, steel frame, 65' complete.
Bucket elevator 8"x6"x12", centers 32 ft.
Barber Greene portable conveyors 24", steel frames, electric drive, 35' to 45' Type N.

CRANES—SHOVELS

Marion Model 450, gas electric shovel, 1¼ yd.
Lima Model 101, crane 50' boom 1¼ yd.
Northwest Model 4 crane and shovel, 1 yd.
P&H Model 600 crane, 1 yd.
Osgood "Conqueror" crane and shovel, 1 yd.
Northwest Model 105, crane, shovel, backhoe, ¾ yd.
P&H Model 400 crane and shovel, ¾ yd.
Industrial Brownhoist crane, 10 tons.
Browning truckcrane.

MISCELLANEOUS

Koppel V Type 2 yd. 36" ga. steel side dump cars.
Gas locomotives from 2½ to 35 tons, 24", 36" std. ga.
Dredge pumps, gas, electric, steam, 6", 8", 10", 12", 16".
Air Compressors, 220, 310, 450, 523, 750, 1000, 1300 ft.
Fuller Kinyon portable bulk cement unloader Licensed.
2 REX 288 concrete mixers gas operated, power discharge. Calibrated water tank, low charge, skid mounted.
Dual Pumperete with 420 ft. of 8" pipe line.
Steel Stiff leg derrick 80' boom, 10 ton cap.
Lidgerwood 3 drums and swinger 50 HP electric hoist.

RICHARD P. WALSH CO.
30 CHURCH STREET, NEW YORK, N. Y.

EXCELLENT VALUES

RECONDITIONED AND REBUILT EQUIPMENT

25—Portable Air Compressors—110'—220'—360'.
2—C.P. Model "100" Wagon Drills.
1—Demonstrator I.R. FM-2 Wagon Drill X-71 Drifter.
4—I.R. Model EW-2000 lb. Air Tuggers.
2—Blaw-Knox Bins—72 ton—Weighbatchers.
10—Owen Clamshell Digging and Rehandling ¾ to 2 yd.
8—Crawler Tractors with Bulldozers—Cat. "30" and "60" A.C. "35"—McCormick-Deering "40" Diesel & Gas.
2—Portable Belt Conveyors—25' length.
1—⅜ yd. Byers Crane—full revolve—35' boom & Backhoe.
1—Browning Steel Erection Crane—20 ton cap. 72 ft. gooseneck boom—full revolve—gas—on crawlers 1¼ yd.
1—Otis Model "A" McCormick-Deering Tractor Crane.
24—Hoists—gas—elec.—steam & air—all sizes—w/o swingers.
1—4-6 yd. Blaw-Knox Truck Mixer or Agitator.
2—Iron Mules H-K—2 yd.
90—Pumps — self prime — Cent. — Vertical—open & closed Diaphragm plunger—triplex road, etc.
1—½ yd. Austin Full Revolve Gas Shovel & Crane.
2—1 yd. Osgood Comb. Shovels & Cranes.
2—Industrial Brown Hoist Steam Comb. Shovels & Cranes 1¼ yd.—50 H.P. Boilers—50' booms.
3—200 & 300 Amp. Elec. & Gas driven Arc Welders.

Write for our "New" Complete Equipment List—Just off the Press

RENTAL SERVICE CO., INC.
20TH & VENANGO STS. PHILADELPHIA, PA.
Sag. 2700

MODERN

AIR COMPRESSORS

All Types and Sizes

Rebuilt-Guaranteed

EARL E. KNOX COMPANY
20 W. 2nd St. Erie, Pa.

Sullivan Compressor

1300 cu. ft. Sullivan Angle Compound Air Compressor No. WN-3-20 x 12 x 14—Serial No. 8977—purchased new January, 1926—direct connected General Electric 225 HP—Form K—Type I—257 RPM—220-440 volts—600 Amps. —3 phase—60 cycle with starter.

EASTERN METALS CORPORATION
81 Polk St., Newark, N. J.

ELECTRICAL MACHINERY

Motors and Generators. A.C. and D.C., for sale at attractive prices. New and Rebuilt. All fully guaranteed. Write for List and Prices.

V. M. NUSSBAUM & CO.,
Fort Wayne, Indiana

22—Koppel 30 Yd. All Steel Air Dump Cars—Rebuilt.
25—20 Yard, All Steel Air Dump Cars—Overhauled.
50—100,000 Capacity, All Steel Bottom Dump Cars.
1—Brownhoist 15-ton 8-Wheel Locomotive Crane.
1—American All Steel Full Revolving Railroad Ditcher.

PETER E. MEAGHER
Lyceum Building Duluth, Minn.

New—RAILS—Relaying

ALL SECTIONS

Also contractors' equipment, "V" shaped and Western cars, 24 and 36-in. gauge, portable track, gas locos, frogs and switches. Attractive prices quoted, wire, write or telephone for quotations.

M. K. FRANK
480 Lexington Ave. New York, N. Y.
25 St. Nicholas Building, Pittsburgh, Pennsylvania

75-Ton capacity Link-Belt gravel classifier.
50-Ton capacity Link-Belt sand classifier.
American double drum hoist, 80 H. P. electric motor.
Two 3 cu. yd. skip cars.
For Sale or Exchange for 24" trussed type belt conveyor equal value.

MISSISSIPPI SAND & GRAVEL CO.
KOLOLA SPRINGS, MISS.

B-G Loaders—Models 82-62-42-25-21. Also Hains.
Crushers—10" Sup-McCully, 10" & 7" Newhouse, 24x36-18x24-15x36-10x30- RB-12x24-9x36-8x24-9x16.
Sauerman equmt.—Holstu-Buckets-etc., ⅛ to 4 yds.
1 Yd. gas shovel-crane-drag, 40' boom. Bargain.
Electric Shovels-Cranes-Draglines-⅝ to 3 yds.
Crane-Dragline, ⅝ yd., 25'-30' boom. Full rev.
Truckcranes—full rev., 4 wheel pneu., & 6 wheel.
Buckets—Clam.-Drag.-Scraper-Slackline-⅛-8 yds.
Diesel Engines—Compressors—Conveyors—Screens.

JAMES WOOD
53 W. JACKSON BLVD. CHICAGO, ILL.

DAVENPORT LOCOMOTIVE

One 11 x 16 Standard Gauge Davenport Locomotive For Sale cheap if sold soon. In fair condition and can insepct at any time at our plant near Dresden, Ohio.

THE ZANESVILLE GRAVEL COMPANY
Dresden, Ohio

USED EQUIPMENT FOR SALE

SPECIALS

1—90" x 50' Buggles Coles Class XA14 Dryer. "Almost New". Complete.
1—375 H.P. Westinghouse Type H.F. Motor, 3 Phs. 60 Cyc. 440 Volt. 580 R.P.M. "Excellent Condition".
4—No. 60 & 4 No. 80 Bailey Feeders.
1—Myer-Whaley No. 4—Shovel.
2—6" Type "E" Fuller Kinyon Pumps (Complete).

ALSO:

"COMPLETE ROCK CRUSHING PLANT:"

1—Allis Chalmers-SK-Ser. 6256 Gyratory Crusher, with 150 H.P. Motor. 3 Phs. 60 Cycl. 220 Volt.
1—Allis Chalmers 5K Ser. 7171 Gyratory Crusher.
1—Ingersoll Rand Compressor 575' Imperial Type XRB, 2 stage, belted to 105 H.P. Gen. Elec. Motor, 3 Phs. 60 Cyc. 2300 Volt, with Air Receiver & Unloader Complete.

For sale as whole or in part at bargain prices. Also Dryers, Crushers, Pumps, Cars, M. G. Sets, etc.

Write, wire, or call us for complete list.

FREESE EQUIPMENT SERVICE
1529 E. 65th Place, Chicago, Ill.
Tel. Dorchester 0162

CRUSHERS

GYRATORY: 42" McCully with 80% brand new parts. 21-K Gates (42"). 36" Superior McCully like new. 20" Superior McCully reduced to 16". Telsmith Nos. 4, 5, 6 & 9. Gates Nos. 10, 9, 8, 7½, 6, 5, 4 & 3. Also Austins, Kennedys and Traylors.
JAW TYPE: Traylor 84x66, 60x48, 30x60 & 24x72. Buchanan 52x72 & 30x42. Farrel 24x36 & 30x36. P&M 24x36. Good Roads 1030 & 1040. Bakstad 3-jaw 8x20. Misc. 9x16, 8x36, 15x36. Etc.
REDUC. TYPE: 6, 10 & 18" Super. McCulley. 2', 3' & 4' Symons Cone. 7" Newhouse, etc.
ROLLS: Allis-C. 86x16, 40x15 & 54x24. Jeff. 30x30.
HAMMERMILLS: Williams Nos. 3, 4, 5 & 9. Others.
MILLS: Kennedy Ball 4x6, 5x6 & 5x8. Kent 34x7". 48" Fuller-Lehigh. 5'x22' Bonnot and others.

MISCELLANEOUS ITEMS

Barges, Bins, Buckets, Boilers, Cableways, Cars, Compressors, Conveyors, Cranes, Dryers, Derricks, Draglines, Dredges, Drills, Engines, Excavators, Elevators, Generators, Hoists, Kilns, Loaders, Locomotives, Motors, Pipe, Pumps, Rail, Scales, Screens, Slacklines, Shovels, Tanks, Trucks, Tractors, and many other items located throughout the United States at Bargain Prices.

ALEXANDER T. McLEOD
7229 ROGERS AVENUE CHICAGO

1—6½ yd. Bucyrus Elec. Shovel 320B-90' boom.
1—30 ton Browning Crane, 60' boom.
4—700 to 1000 GPM, 250', H. Motor dr. pumps.
1—10" AMSCo Full Manganese Pump.
5—Sullivan Air Rock Drills.
3—Mine Hoists, Electric and Steam.
5—Locos., Std. and 36" Ga.
60—Dump Cars, 5-12 and 20 yd. Std. & 36" Ga.
Steel Buildings, various sizes.

IRON & STEEL PRODUCTS, INC.
Chicago (Hegewisch Sta.), Ill.
"Anything containing IRON or STEEL"

MUST BE MOVED QUICKLY

2—3 ton Plymouth 36" gauge Gasoline Locomotives.
1—Link Belt Portable Loader 18" x 22'.
4—Link Belt 60" Dehydrating Cones.
4—Sauerman ¼ yd. Buckets with extra manganese lips.
1—Raymond No. 1 Impact Mill.
1—Gruendler 18 x 24" Double Roll Crusher.
1—P & M 12" x 12" Balance Rolls.
1—Tyler 3 x 5 Vibrating Screen.

BRILL EQUIPMENT CORP.
183 VARICK STREET NEW YORK, N. Y.

FOR SALE

5 Circular Steel Gravel Tanks from 30 to 45 feet in height and 15 feet in diameter. **Address Box No. 843, Care of Rock Products, 205 West Wacker Drive, Chicago, Ill.**

RELAYING RAILS

All Sizes — Any Quantity
Write for Quotations

Midwest Steel Corporation
CHARLESTON, W. VA.
Tie Plates — Angle Bars — All Accessories

USED EQUIPMENT FOR SALE

30—Compressors, 60'—1500' steam, elec., gas drive.
17—Boilers, 50-150 h.p., vert. & horiz., ASME.
15—Buckets, ½—2½ yd. clamshell, orange peel.
30—Hoists, 2 & 3 drum, all sizes, steam, gas, elec.
1—Pulverizer, Jeffrey, 28" hammers, 20¼" grates.
1—Gyratory Crusher, Traylor Bull Dog, 8" Type T.
2—Gyratory Crushers, Traylor Bull Dog, 12" Type T.
2—Pebble Mills, 6'9"x8' Silex-lined, Type PK-20.
1—Sand Roll, Traylor, 36x16 Type A.
Conveyors, 20"-36", all lengths, some truss mounted.
1—Conveyor, Apron, 24"x21' c. to c.
1—Model 200 P. & H. Crane, 35' boom, gas.
1—Model 50-B Bucyrus-Erie steam crane or shovel, 50' boom.
3—Transit mix bodies, 2-1½ yd., 1-1 yd.

COAST-TO-COAST EQUIP. CORP.
101 W. 31st St. New York, N. Y.

WRITE Dept. 33 for 1938 net price catalog on new and reconditioned power transmission equipment.

Teuscher Pulley & Belting Co.
St. Louis, Mo. Since 1899

FOR SALE

REBUILT MACHINERY

1—**P & H** Model 400 **Crawler Crane**
1—**P & H** Model 202B **Truck Crane**
1—**Universal Truck Crane**
Write for Prices

R. B. WING & SON CORP.
Albany New York

USED EQUIPMENT WANTED

WANTED

Symons horizontal disc crusher. 48 inches. Answer giving lowest cash price, location, condition, etc. **Address Box No. 839, Care of Rock Products, 205 W. Wacker Drive, Chicago, Ill.**

WANTED TO PURCHASE

Spider (or top hub casting with arms) for a No. 7½ Austin Gyratory stone crusher, old type, either new or in good used condition. Also head and main frame. Apply to

R. H. MINER COMPANY LIMITED
7411 Delanaudiere Street, Montreal, Canada

WANTED TO BUY THREE YARD

Transit mixer to be mounted on semi-trailer, will buy with or without trailer. **Address Box 842, care of Rock Products, 205 West Wacker Drive, Chicago, Ill.**

POSITIONS WANTED

QUARRY SUPERINTENDENT DESIRES a permanent position with 25 years of experience in operating stone crushing plant. Can furnish excellent references. Address Box 837, care of Rock Products, 205 W. Wacker Drive, Chicago, Illinois.

POSITIONS WANTED

ASST. SUPERINTENDENT OR SHIFT Foreman position wanted by an American with good education; over fifteen years experience in operation of wet and dry cement plants including construction and machinery installation. Address Box 834, Care of Rock Products, 205 W. Wacker Drive, Chicago, Ill.

EXECUTIVE POSITION DESIRED IN operating division of a progressive limestone or industrial sand company by graduate mining engineer with 17 years' experience in the development and operation of open pit and underground quarries; design, construction, operation and maintenance of crushing, screening, drying and washing plants; past eleven years in the capacity of general superintendent. Now employed but available on sixty days' notice. Address Box 841, Care of Rock Products, 205 West Wacker Drive, Chicago, Ill.

PLANT SUPERINTENDENT OR ENGINEERING Executive available on reasonable notice. Am American born, graduate engineer with over twenty years experience in the design, construction and operation of industrial plants, wet and dry cement plants, mines and quarries, handling labor on large scale production. Future opportunity more important than starting salary. Address Box 828, Care of Rock Products, 205 W. Wacker Drive, Chicago, Ill.

POSITIONS VACANT

WANTED—YOUNG MAN EXPERIENCED in gravel plant operations in the capacity of superintendent or assistant superintendent. Chicago territory. State age, last salary and past experience in detail. Address Box No. 830, Care of Rock Products, 205 W. Wacker Drive, Chicago, Ill.

CONSULTING ENGINEERS

WE LOOK INTO THE EARTH

By using Diamond Core Drills. We drill for Limestone, Gypsum, Talc, Fire Clay, Coal and all other minerals.

PENNSYLVANIA DRILLING CO.
Drilling Contractors
Pittsburgh, Pa.

RAY E. CRAUMER

CONSULTING ENGINEER
Mining—Mechanical—Combustion
30 Years Experience in Operation and Design

Management	Air Conditioning	Kilns
Reports	Power Plants	Incinerators
Safety Work	Plant Layouts	Furnaces

1617 So. 16th Ave., Maywood, Ill.
Phone No. 2836

H. D. RUHM

Consulting Engineer
PHOSPHATE LANDS
all grades of rock.
PHOSPHATE FILLER
40 years' experience TENNESSEE PHOSPHATE FIELD. Correspondence solicited. Can find what you want if it can be found.
805 West Seventh St., Columbia, Tennessee

Wire or write us for
DIAMOND CORE DRILLING SERVICE
with thirty-five years' experience. Steam, Gasoline and Electric drills suitable for any job. Satisfactory cores guaranteed. Prices reasonable.

HOFFMAN BROTHERS DRILLING CO.
Drilling Contractors PUNXSUTAWNEY, PA.

H. J. BROWN

CONSULTING ENGINEER
25 Doane Street, Boston, Massachusetts
Specializing in Gypsum Plants and in the Mining, Quarrying and Manufacture of Gypsum Products.

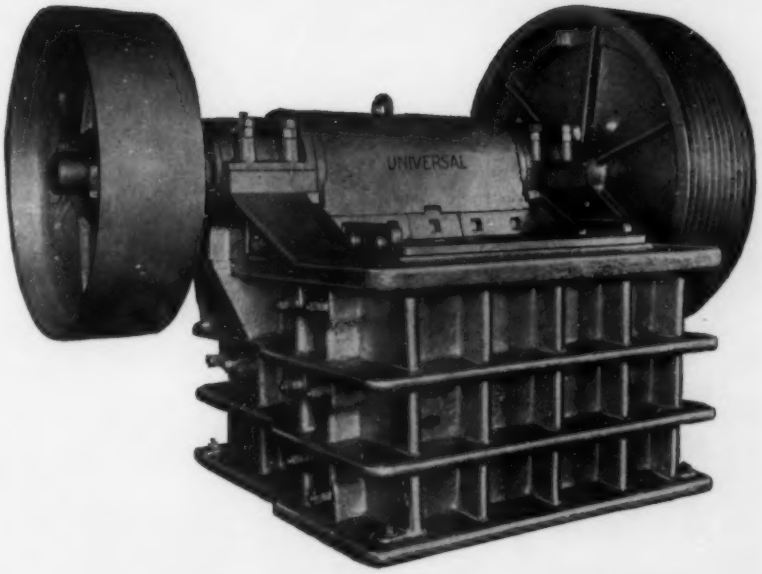
Consultation	**Design**
Examinations	**Construction**
Reports	**Supervision**

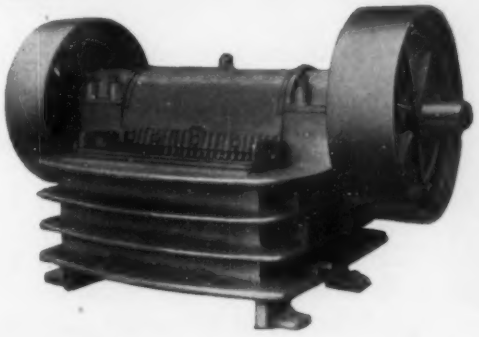
INDEX OF ADVERTISERS

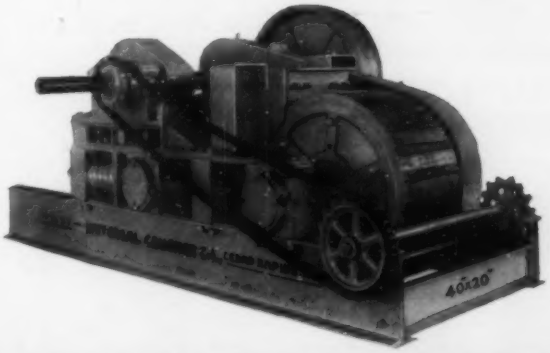
LOW COST VOLUME!

Low cost volume means greater profits and you get them with Universal Crushers. They produce crushed rock and gravel faster, of greater uniformity, and at a lower cost per yard because of superior Universal design.

The wide feed opening, the six bearings (two on the pitman and two on each side), the two crushings with each shaft revolution provided by the double-action stroke, the quick simple product size adjustment and the rugged construction that minimizes replacements even under the severest service abuse are only a few of the reasons why operators prefer Univeral Crushers.





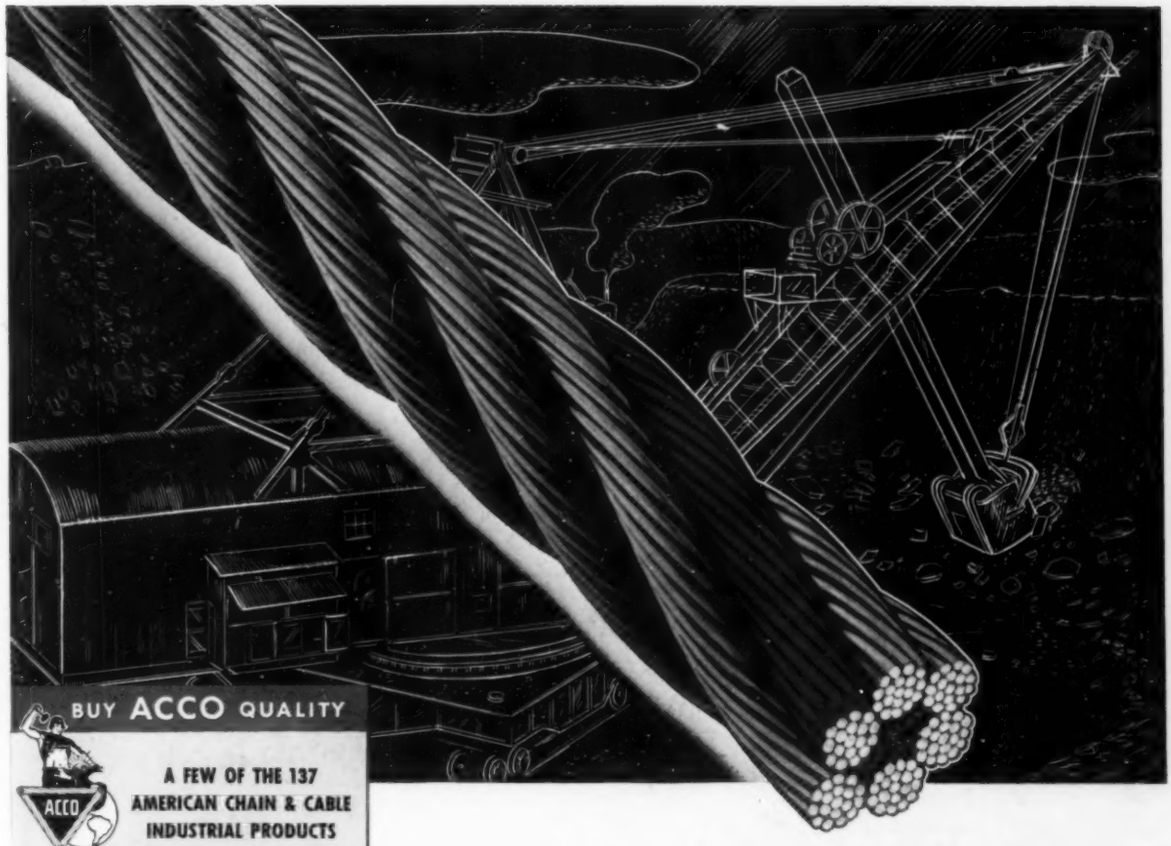


Universal Jaw Crushers are made in 22 sizes with bronze bearings and 9 sizes with roller bearings. Universal Roll Crushers, too, are superior in design and built for low cost volume. Both are available in over 50 combinations of stationary, semi-portable and portable crushing, screening and loading plants.

Write for catalog and name of the Universal distributor near you.

UNIVERSAL CRUSHER COMPANY
617 C Avenue West
Cedar Rapids, Iowa

UNIVERSAL



BUY ACCO QUALITY

A FEW OF THE 137 AMERICAN CHAIN & CABLE INDUSTRIAL PRODUCTS

AMERICAN CHAIN DIVISION
(DOMINION CHAIN COMPANY, Ltd., in Canada)
Weed Tire Chains • Welded and Weldless Chain • Malleable Castings
Acco-Morrow Lubricators

ANDREW C. CAMPBELL DIVISION
Abrasive Cutting Machines • Floformers
Special Machinery • Nibbling Machines

FORD CHAIN BLOCK DIVISION
Chain Hoists • Trolleys

HAZARD WIRE ROPE DIVISION
Lay-Set Preformed Wire Rope • "Korodless" Wire Rope • Preformed Spring-Lay Wire Rope • Guard Rail Cable

HIGHLAND IRON & STEEL DIVISION
Wrought Iron Bars and Shapes

MANLEY MANUFACTURING DIVISION
Automotive Service Station Equipment

OWEN SILENT SPRING COMPANY, Inc.
Owen Cushion and Mattress Spring Centers

PAGE STEEL AND WIRE DIVISION
Page Fence • Wire and Rod Products
Traffic Tape • Welding Wire

READING-PRATT & CADY DIVISION
Valves • Electric Steel Fittings

READING STEEL CASTING DIVISION
Electric Steel Castings, Rough or Machined Railroad Specialties

WRIGHT MANUFACTURING DIVISION
Chain Hoists • Electric Hoists and Cranes

In Business for Your Safety

FOR ALL TOUGH JOBS

LAY-SET Preformed Wire Rope is built to stand the tough jobs. . . . The abuse as well as use to which all rope is subjected—jerking, reverse bending, straining—LAY-SET Preformed takes them all in its stride. More than that—LAY-SET almost refuses to kink or whip; it spools perfectly; has amazing resistance to fatigue. That's why LAY-SET Preformed lasts longer—gives better service—reduces the frequency of shutdowns—increases production. Be sure your next line is LAY-SET Preformed.

GREEN SIGNIFIES SAFETY

HAZARD WIRE ROPE DIVISION
Established 1846
AMERICAN CHAIN & CABLE COMPANY, Inc.
WILKES-BARRE, PENNSYLVANIA
District Offices: New York, Chicago, Philadelphia, Pittsburgh, Fort Worth, San Francisco, Denver, Los Angeles, Atlanta, Tacoma

LAY-SET *Preformed* WIRE ROPE

ALL HAZARD WIRE ROPES MADE OF IMPROVED PLOW STEEL ARE IDENTIFIED BY THE GREEN STRAND

The SHOCK is absorbed!

YOU can't avoid Shock in cable-tool drilling —but you can absorb it! This is done in Bucyrus-Armstrong blast-hole drills at the four main points of shock contact by using exclusive, patented, RUBBER shock-absorbing devices—

1. Bucyrus-Armstrong rubber shock-absorber under the crown sheave (consisting of 12 to 28 tough rubber discs).
2. Rubber-cushioned tool guide.
3. Rubber-insulated spudding-beam sheave.
4. Rubber-insulated heel sheave.

This efficient and economical protection at the four vital shock points gives Bucyrus-Armstrong drills longer life and lower maintenance. Also, the resulting sharp, snappy upstroke actually produces more footage. The rubber shock-absorber gives the required elasticity to wire line cable, decreasing cable wear. And the rubber on which the shocks of drilling are concentrated gives long life service and is inexpensive to replace. These money-saving, profit-producing features are found only on the Bucyrus-Armstrong line of blast hole drills—27-T, 29-T, and 42-T. Write for details.

BUCYRUS ARMSTRONG

H4

BUCYRUS-ERIE

SOUTH MILWAUKEE, WISCONSIN, U. S. A.